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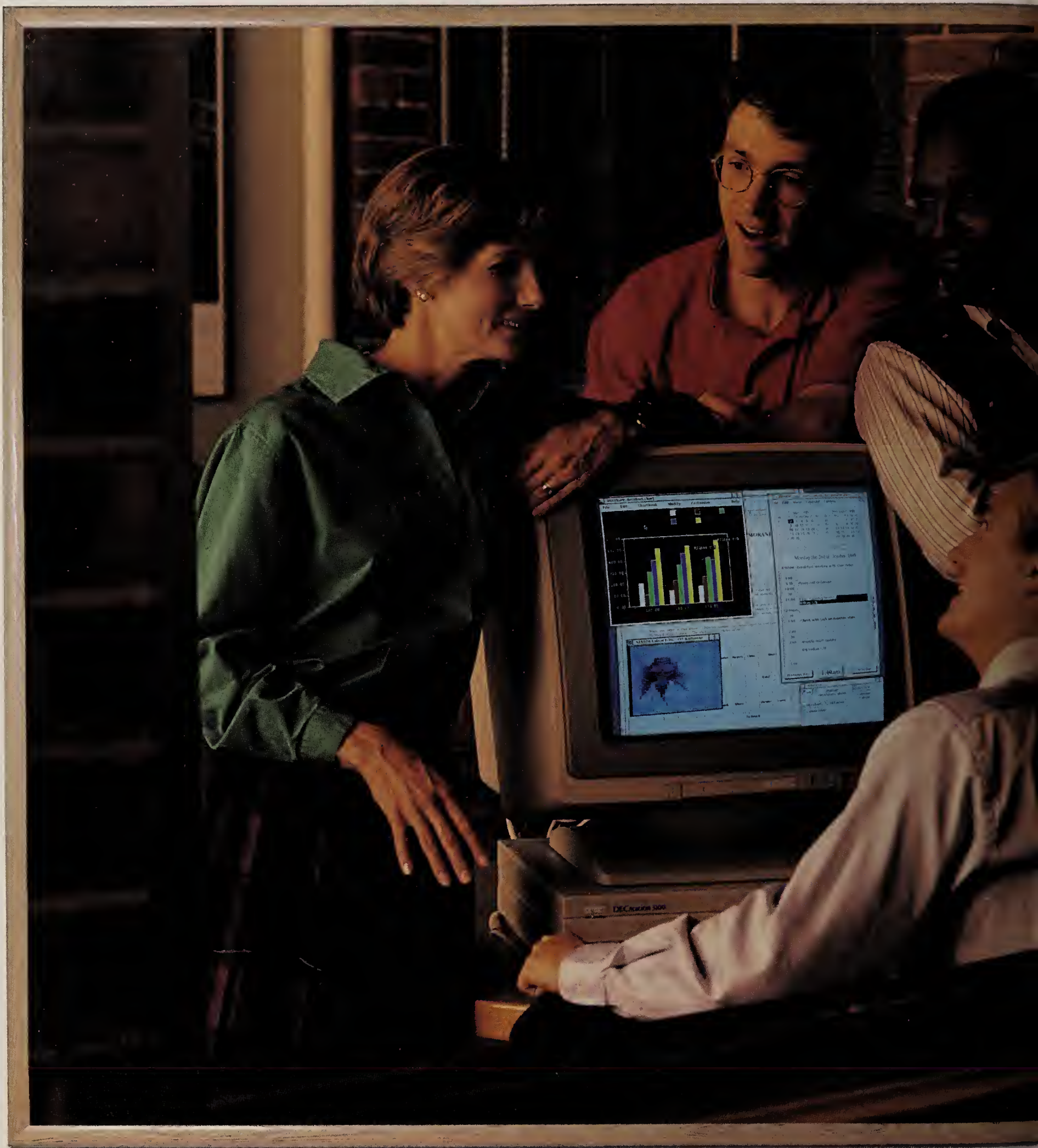
THE MAGAZINE FOR INFORMATION EXECUTIVES

JANUARY 1990

VOLUME THREE NUMBER FOUR

SEVEN DOLLARS

SURVEYING TOP EXEC'S' VIEWS ON TECHNOLOGY — FOURTH- GENERATION LANGUAGES



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Cover photo by
John Kennard

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Last spring *CIO* met with principals of Coopers & Lybrand in New York. The people at C&L were interested in exploring how top executives perceived the CIO role. We and the C&L team discussed the subject at length and decided to survey senior non-IS executives.

Over the past several months, C&L conducted an extensive survey for *CIO*—200 telephone interviews with CEOs, COOs and CFOs. The results suggested that top executives were satisfied with their CIOs and IS organizations. In fact, the picture the survey data painted was very rosy—far too rosy for our consultants at C&L.



Recently, Managing Editor Lew McCreary and Senior Editor Allan E. Alter met with C&L partners Michael W. Bealmear and Ronald T. Brzezinski and Marketing Director Jacqueline E. Jeffrey to critique the survey results. Instead of merely reporting data in neat columns and rows, our cover story ("Good News, Bad News," Page 18), examines the findings in an effort to explain why the results

ran counter to everyone's expectations.

For example, most top executives view CIOs as key members of the corporate management team, yet few CIOs are on broad career tracks and there is a high percentage of turnover among their ranks.

Our C&L gurus also felt that CEOs may have been reluctant to reveal their true opinions about their CIOs' status and achievements because there is a lot of pressure to jump on the competitive-edge bandwagon. True, there are many CEOs who have seen the IT light, but there remains a pressing need for the top corporate executive to become IT savvy.

Pursuing this theme, we also interviewed several chief executives in depth to determine how they came to be IT true believers ("Cornerstones," Page 32). All agreed that the CEO has to be a strong proponent of IT. But they also agreed that IT's potential has not yet been realized. As Norman Phelps, CEO of National Liberty Corp., said, "It's easy to say that IT should be viewed as a strategic weapon, but the hard work is turning that into something real. . . . When you think about automating . . . you have to rethink your ways of doing things."

CIO's collaboration with C&L on this well-executed project was stimulating and offered insight into a topic that is increasingly finding its way into management journalism: how to calculate the true contribution of information technology to organizational well-being and how to give the IS function the clout its potential impact merits. C&L plans to revisit its respondent base later this year to enlarge the picture created by last year's survey.

Marcia Blumenthal



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Joseph L. Levy

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Marcia Blumenthal

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Lew McCreary

ART DIRECTOR
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Abbie Lundberg

EDITORIAL ASSISTANT
Megan Santosus

ART ASSISTANT
Moirra Gillis

CONTRIBUTING WRITERS
John Clippinger, Dudley Cooke,
Linda Fleit, David Freedman,
Mickey Williamson and Ninamary Bubba
Maginnis

CONTRIBUTING ART DIRECTOR
Meg Birnbaum

ASSOCIATE PUBLISHER/DIRECTOR OF
ADVERTISING SALES
Robert E. Block

MARKETING SERVICES MANAGER
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Framingham, Mass.
01701-9208 (508) 872-8200

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PHOTO BY RUSSELL WINDMAN

Northgate Slims Down!



Photographs: Harry Langdon

Slimmer. Trimmer. The world's smallest 386, standing not even as tall as America's favorite diet cola. Obviously Northgate has lost a few pounds.

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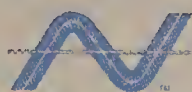
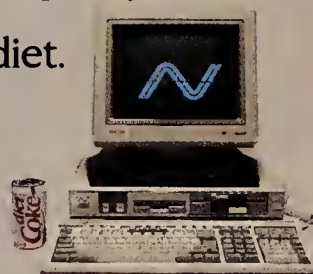
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January, 1990

"When you're going to invest millions of dollars in infrastructure, as the U.S. did in road systems, or the electric power system, standards are required. The computer industry is on the verge of such infrastructural investments."

- Robert M. Metcalfe, Founder
3Com Corporation

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Welcome to 1990. Warfare continues in the information industry. Battles are occurring as the industry recognizes that the key to the future is standardization.

Why are standards so important? Many of you may remember that IBM was supposed to be a \$100 billion company in 1990. They are not going to make it. Growth in the industry has been slowing. The reason the industry is slowing down is because you are getting ready to invest a vast sum of money in information systems.

The information industry today is in the same situation as the automobile industry, telephone industry, and the electric power industry 100 years ago. The technology is at hand. Society is about to invest trillions of dollars in infrastructure based on these technologies.

The trillions are hard earned and won't be spent until vendors and users of information technology get together and establish the standards upon which these investments are going to be made.

You, as America's information leaders, are demanding standardized equipment so that you are not locked into using only one vendor. Being able to use any software on any computer would allow unprecedented choice in shopping for computers. This would certainly help the industry grow faster. After all, 1991 is just eleven months away.

Sincerely,

Joseph L. Levy
President and Publisher

P.S. There is still time to register for the first CIO Conference on "Information Strategies and the Bottom Line", February 4-6 in Southern California. Just call Lori Cardarelli (508-935-4631) or Diane Martin (508-935-4274) for more details.

Coming in CIO

Beyond User Friendly

The user-computer relationship amounts to more than just a pretty interface. Instead of an add-on afterthought, the relationship has to be built into system design from from the start. *CIO* looks at the friendlier future.

IT in Transportation

Computerized route-planning, satellite-tracking, bar-coding of inventories—transportation companies are putting the pedal to the metal in their use of information technology.

Disaster Relief

The October earthquake in San Francisco showed the value of having a disaster-recovery plan in place—even when the data center is far from the epicenter. *CIO* examines disaster-recovery options and strategies.

Beach Ball

Information technology has helped the City of Miami Beach turn back a tide of hard times and begin to have fun in the sun again. *CIO* cruises the rejuvenated Collins Avenue.

The Compleat EIS

Executive information systems don't spring fully formed from the eye of Zeus. They need to gestate properly to attain their maximum potential.

BY DUDLEY COOKE

Many executive information/executive support systems (EIS/ESS) fail or are only minimally effective because of the lack of up-front work in the early stages. When considering the implementation of an EIS/ESS, it is highly desirable to perform a "readiness" assessment before making a decision. This assessment would allow significant issues to be mapped to the organization and gauged to determine potential success levels as well as the expected risks. In addition, an overall implementation approach can be developed during the assessment stage to reduce risk and maximize ultimate value to the firm.

Five issues should be addressed in the course of an EIS/ESS project: linkage to business objectives, resources, sponsorship, data and implementation.

Linkage to Business Objectives. It is important to identify business mission, objectives, critical success factors, strategies and information requirements before embarking on the EIS/ESS implementation activity.

This need not be done in great detail because further definition and refinement will occur during implementation. (It is the exception rather than the rule that an executive or group of executives can articulate, up-front, a comprehensive set of requirements for an EIS/ESS.)

EIS/ESS can provide value to top executives,

functional executives or business division general managers. These support systems will include dimensions that are unique, customized to the executive and the corporation. Such requirements must be identified before a delivery technology vehicle is chosen.

The typical EIS/ESS is developed to keep executives better informed and to help them make better decisions, but not generally for quantifiable hard-dollar benefits. EIS/ESS should be viewed as a long-term investment with a three-year, or longer, payoff.

Resources. The proper resources must be applied to the development of an EIS/ESS. Dollars translate into people and technology, which must be chosen carefully—the right people and the right technology to support the process.

The existing level of technological maturity of the corporation should be taken into consideration. The organization must have developed a reasonably sound technology platform and should have an acceptable level of information technology "comfort."

An EIS/ESS must be easy to use, highly integrated, have easily interpretable output, good communications capabilities and good response time. The delivery technology must therefore be relatively state-of-the-art, and there must exist a skilled staff to support its use.

The implementation team should consist of the following people:

- An Executive Sponsor, who acts as the driver of the process and has the authority to obtain resources and direct activities. The sponsor must be a believer and understand the value of the EIS/ESS.

- A Team Leader, who takes responsibility for project management, momentum and visibility. The team leader must have group leadership



skills and a solid knowledge of business concepts and technology, and should also possess significant experience in the development methodology of iterative systems.

- **Functional Expert**, who would provide specific corporate functional knowledge (accounting, human resources, etc.) during the development process.

- **Systems Technology Adviser**, who would provide technical analysis and facilitate technology acquisition.

- **Systems Builder**, who would develop the specific EIS/ESS application on the chosen technology platform.

In assembling this cast, bear in mind that the EIS/ESS prototyping process should be relatively unstructured. Typical IS professionals are accustomed to stringent systems life-cycle methodologies and may be uncomfortable with the EIS/ESS development process.

Sponsorship. Probably the most obvious cause of success or failure is executive sponsorship. There must always be an executive involved to assure organizational commitment and leadership. The executive must not only be involved but visibly committed to the development process.

Commitment means that the executive:

- has an innate understanding of the EIS/ESS development process and a realistic vision of what the end product will be;

- actively supports the people (project leader, functional experts, system developers) and technology required for the effort;

- involves himself in discussions and hands-on systems sessions;

- takes an active ownership position.

If the senior executive does not get excited about the potential value of an EIS/ESS, he will not take a visible posture to drive the process. This issue must be addressed before the EIS/ESS process is initiated and should be an important element of the risk-assessment phase.

Data. An often-overlooked aspect of developing EIS/ESS is the data requirement. Corporations vary greatly in the comprehensiveness and sophistication with which they manage data

resources. The degree to which Information Resource Management (IRM) has been applied to develop data-management techniques, methodologies, models, technology, architectures and policies can have a major impact on the total EIS/ESS effort.

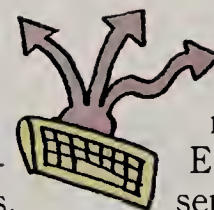
Issues of quality (accuracy, availability, timeliness, completeness), ownership and security, if not well addressed by internal information-management programs, can cause issues of data access to loom larger than all the combined other EIS/ESS tasks in the implementation effort.

An overall assessment of the capability of the IS infrastructure to manage data should be performed early to give an indication of the effort to acquire data for the EIS/ESS.

Implementation. The implementation of an EIS/ESS should not be attempted utilizing a traditional, structured, systems approach. Executives frequently cannot identify their total requirements up front or wait 12 months to see the completed "system solution." Requirements can be stated initially and then tested through prototyping and executive hands-on sessions. By using an iterative development approach, the EIS/ESS can be refined and enhanced.

This allows the executive to participate in a learning process and build a sense of ownership as the EIS/ESS is developed and tailored to his true needs. The executive is controlling the direction of the effort on an ongoing basis.

Inherent in the development process, and critical to its success, are issues of change management. Implementation of an EIS/ESS necessitates changes in management processes related to collection, analysis and reporting of data. Existing decision-making and priority-setting processes can be significantly altered. These changes modify the job content of many employees from the executive sponsor down through the organization. Failures of EIS/ESS are often related to poor change-management techniques (or complete disregard of the issue) rather than to system requirements or technological



problems.

Key elements of a change-management approach to EIS/ESS development would include sensitivity to individual information comfort levels; management of resistance to change; coaching of key executive users; management of expectations; cultural impact (familiarity with use of terminals, systems, technology, etc.); management style conflicts; development of buy-in/ownership; involvement of all key individuals; ease of EIS/ESS use; and communication, communication, communication.

The process of developing and implementing an EIS/ESS may be foreign to many companies. It is imperative that organizations understand why traditional system-implementation approaches do not address key EIS/ESS issues and that an iterative, change-management-oriented process is required for implementation.

The management decision chain in an EIS/ESS project should start with a readiness assessment, be followed by system selection and preliminary design, and then proceed to implementation. Following an EIS/ESS implementation, an evaluation of the system's effectiveness should be undertaken to determine the results of the implementation and the value being realized from the system.

If the evaluation indicates success, expansion of the system deeper into the organization would be appropriate. During or after expansion, the EIS/ESS should continue to be enriched with added functionality and capability, for individual (through customization) and collective use.

At some point, the EIS/ESS will present management with the opportunity to evolve to new organization structures and processes. This is where the real opportunity lies for management to change the way work is conducted and release real value to the business. This is the EIS/ESS payoff opportunity! The entire process must be vigorously worked to achieve the potential payoff. ☐

Dudley P. Cooke is president of Executive Insights Group Inc., a technology consulting firm based in Bryn Mawr, Pa.

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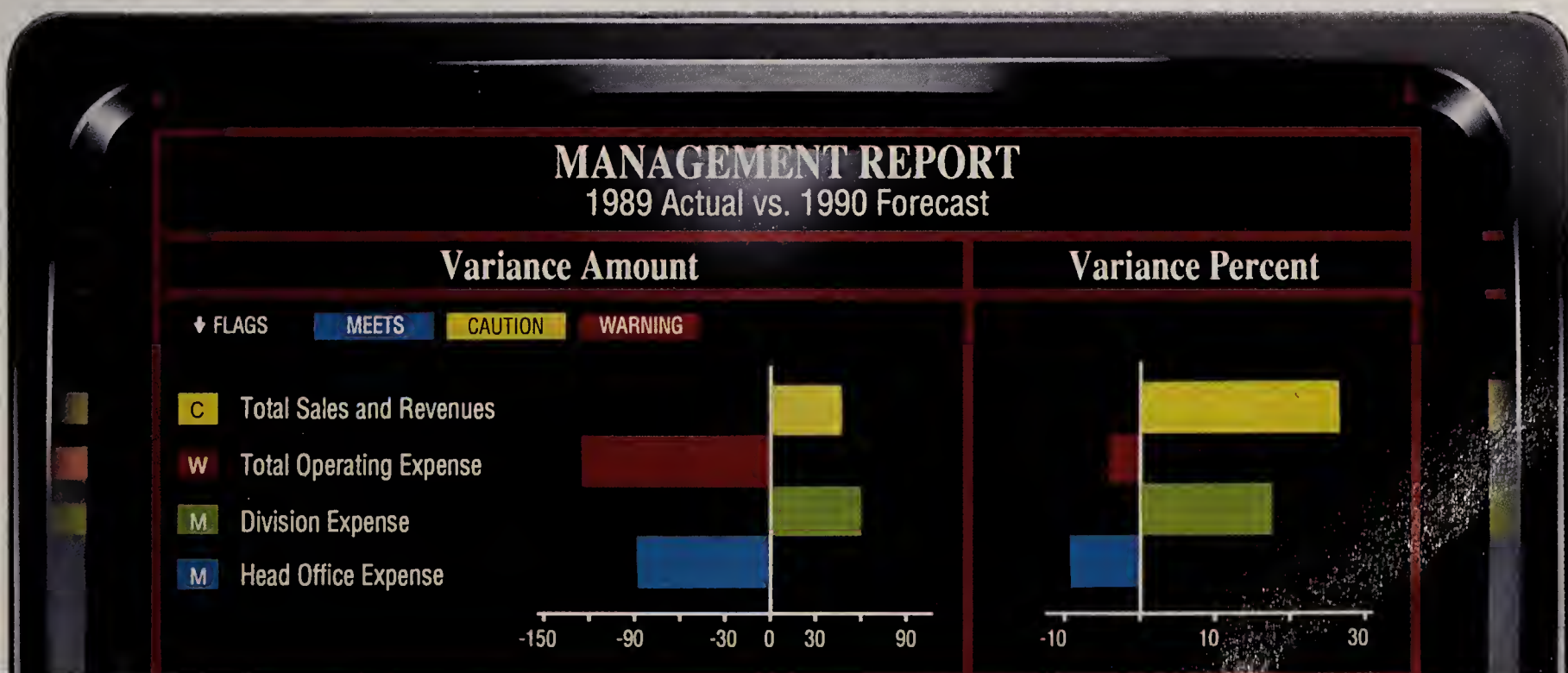
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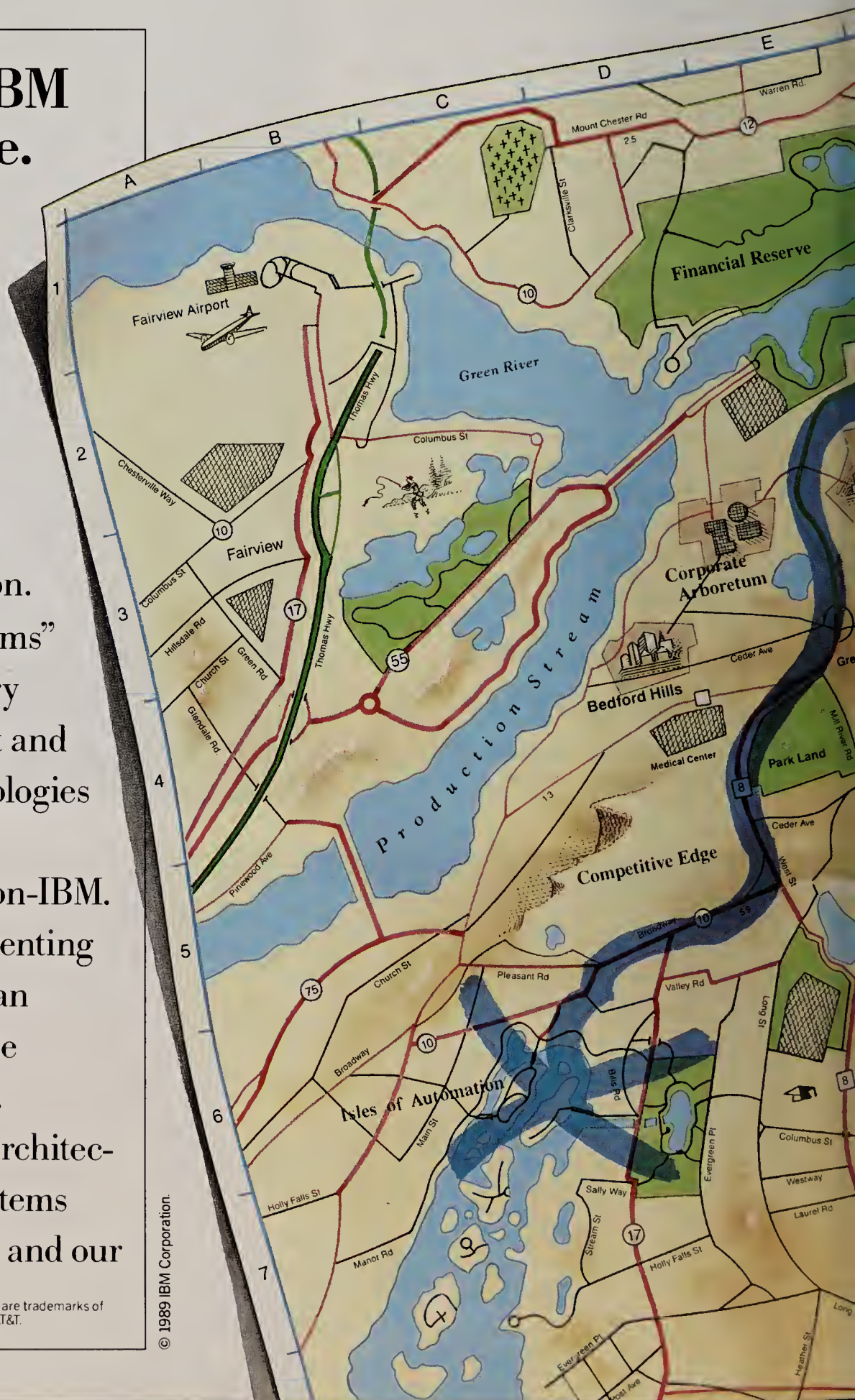
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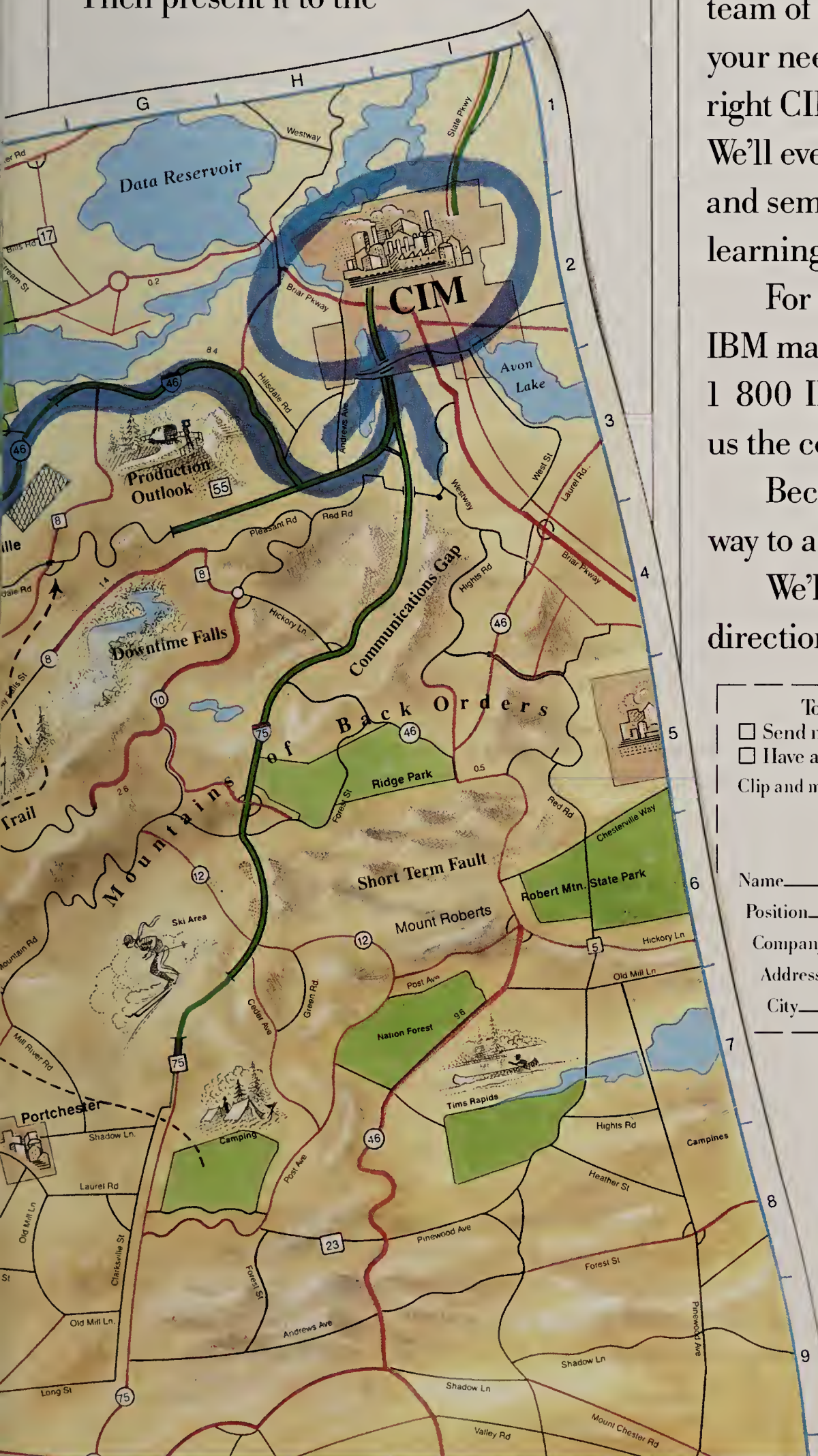
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TRENDLINES

TELECOMMUNICATION

A MODEM FOR THE ROAD

At the rate technology is evolving, the office of the future may well be a four-door, 640K-byte sedan. Telebit Corp., a dial-up modem manufacturer in Sunnyvale, Calif., recently introduced its offering for the wheeled workplace—a high-speed, cellular modem modestly dubbed CellBlazer.

CellBlazer allows users to transmit digital data over the cellular telephone network. The device, which can trans-

mit at speeds from 9,600 bits per second (bps) to 16,800 bps, connects to a cellular phone and a laptop or handheld computer. Data sent from the field travels by cellular switched telephone network to the mobile telephone switching office, where it is transferred to the regular public switched telephone network, which in turn sends it to the corporate host computer.

Telebit Vice President of Marketing Don Gibson and

Senior Product Manager Jim Montrose see big opportunities for CellBlazer in businesses with active field work forces. The company's beta-test sites include an insurance company whose field claim processors use CellBlazer to transmit claim information along with pictures of damaged property to regional claim offices.

Agents can file very detailed claims immediately and speed payment to claimants.

Other potential field users of Cell-

Blazer are delivery services, sales forces and on-site maintenance crews. Gibson and Montrose expect brisk sales among non-nomadic workers as well, in companies that want emergency backup for their terrestrial networks or an alternative to high leased-line costs.

Telebit has paid special attention to the reliability of a product destined to be used in a less-than-reliable network environment.

"There are challenges to [using] the cellular network,"

Montrose admits. "In moving from one cell to another, the

handoff is sometimes so bad that you actually lose the call." An interrupted file transmission requires starting over. According to Gibson, CellBlazer transmits over many frequencies, rather than a single frequency. When transmitting over a "line that has a lot of distortion," said Montrose, "your data rate will go down," but your transmission will still go through without error.

That and an oil change every 3,000 miles should keep you in business. ■

ROI

PEGGING THE DIS PAYOFF

With the rising tide of raw data that comes as a direct result of the rapidly growing capability of information technology, many businesses face the situation of having water everywhere, but not enough to drink. The challenge is to distill the data into a form that can guide productive decision-making (see "State of the

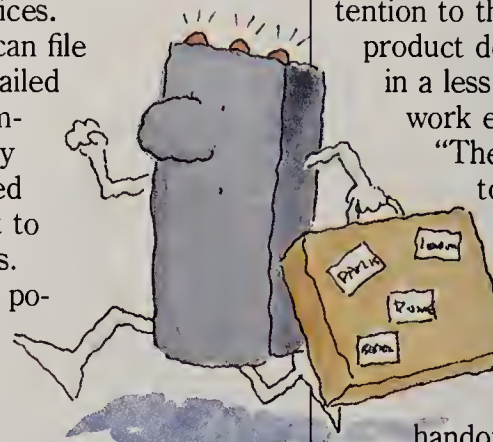


ILLUSTRATION BY SUSAN SMITH

THE DEVIL'S DATA DICTIONARY

In honor of Ambrose Bierce, the famous cynic and author of *The Devil's Dictionary*, CIO has concocted a New Year's hangover remedy of improvisations on a number of words that have annoyed or amused us during 1989. Mr. Bierce defined a cynic as one who "sees things as they are, not as they ought to be." In that spirit we offer the following.

Actionable: a doll with movable joints, preferably one for which weaponry can be purchased separately

Challenge: a disaster in optimist's clothing

Compatibility: like satori, a condition more often spoken of than achieved

Convergence: accidental agreement, or a car wreck

Decentralization: an organizational strategy that becomes the retroactive explanation for abiding confusion

Diarise (to enter an item into a diary): create an exhaustive record in anticipation of accountability (the noun form is diarrhea)

Empower: to distribute unwanted responsibility

Enable: to distribute unwanted responsibility (see empower)

Granularity: referring to those spaces between system modules into which customized error can be introduced

Integration: a melting pot of technological homogene-

ity, more often dreamed of than achieved (see Compatibility)

Interoperability: showing the resourcefulness needed to survive a merger

Lite: the less-capable junior version of any product, as in "Presentation Manager Lite" or "Windows Lite"

Mindshare: like market share, that scarce portion of one's attention span considered to be worth fighting for

Object-oriented: referring to a modular string of code that causes your eyes to glaze over

Optimization: the opposite of pessimization

Paradigm: an example of unattainable excellence, such as Wayne Gretzky

Paradigm shift: the only effective defense against Wayne Gretzky

Systems integration: hardware with its hand in your pocket

Utilize: use, but with great flourish

Virtual: hardly at all

Happy New Year! Bravely, we invite readers to let us know what we've left out. Send amendments and complaints to: Dictionary, c/o CIO, 492 Old Connecticut Path, P.O. Box 9208, Framingham, Mass. 01701. ■

TRENDLINES

Art," Page 60).

Coupled with the need for "actionable" decision support is the imperative to find ways of showing clearly the contributions of technology to the bottom line.

Metaphor Computer Systems, of Mountain View, Calif., has made its reputation in Data Interpretation Systems (DISs), proprietary hardware-software systems that help Metaphor's customers distill volumes of data into effective decision-making. Metaphor recently commissioned a survey to measure the impact of its systems on customers' P&Ls. The survey, conducted by Business Science International, a market-research and consulting firm based in New York, concluded that the nine companies surveyed realized an annual average of \$8.7 million in added profit attributable to DIS use. According to the survey, this one-year profit represented nearly three times each customer's average investment to date in its DIS.

The study found, moreover, that the profit was overwhelmingly the result of revenue-generating applications (94 percent) rather than cost-

cutting enhancements (six percent).

Among the customers' DIS uses: One company was able to allocate its promotions budget more productively by concentrating on its best-performing accounts; another analyzed, and confirmed, the wisdom of an impending price increase in the face of a low-cost competitor's price cut; a bank used a customer-information database to design a new deposit instrument and target it to a select niche, saving in direct-mail costs and generating significant new deposits.

What some readers may find especially intriguing about Metaphor's research on bottom-line impact is—to paraphrase Dr. Samuel Johnson—the fact that it was done at all. With companies struggling mightily to evaluate the results of their investments in technology, there are surely some who would award the Nobel prize for economics to whoever concocts an apt methodology for reliably valuing IT's bottom-line impact. If BSI, which specializes in just such measurements, has indeed done it, maybe we will see them in Oslo. ■

THE FIRST CIO JOKE

The history of any endeavor takes a great leap forward when it begins to find itself funny. Here is what may lay claim to being the first CIO joke. It was told by Robert G. Gilbertson, CEO of Data Switch Corp., in front of a Boston Society for Information Management meeting:

A surgeon, an engineer and a CIO are sitting in a bar, having a drink. They begin to debate what is the world's oldest profession. Surgeon says: "Back in the Garden of Eden, while Adam was sleeping, God

took out one of his ribs and made Eve. What was that if not surgery?"

Engineer says, "Before God created Adam and Eve, God created heaven and earth out of chaos. That was a giant engineering project. Engineering is the world's oldest profession."

CIO gets up off the bar stool. "You're both wrong," he says. "Sure, God created heaven and earth. But who created the chaos?" ■

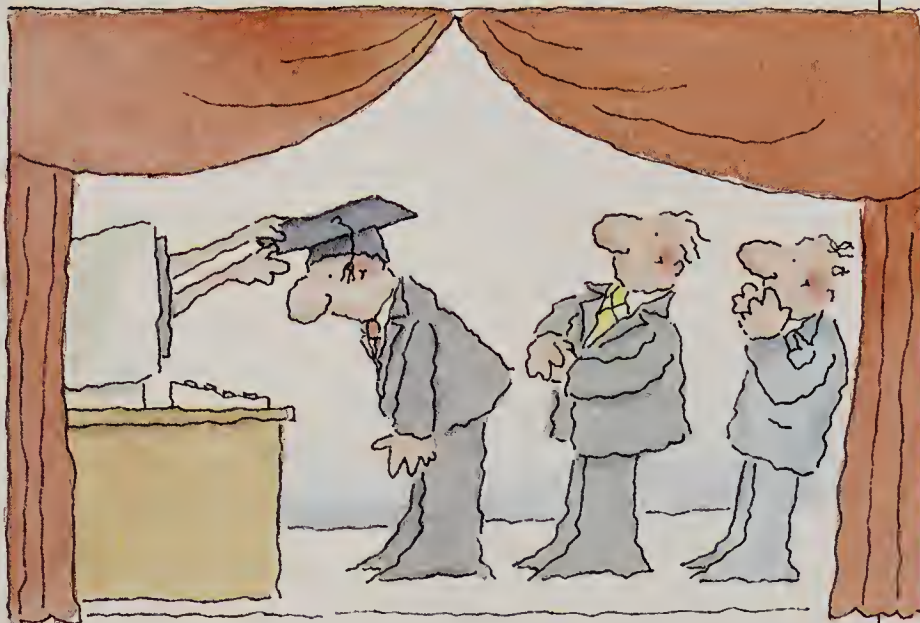
EDUCATION

THE 2400-BAUD CLASSROOM

According to Dr. Eric H. Boehm, CIOs-to-be need special nurture. "There cannot be a new profession without an educational institution," said Boehm, founder and director of the International School of Information Management

course. Students are not isolated. They can 'talk' in class with other students or one-on-one with the teacher."

Everything that is 'said' in class by students and teachers is stored in a cumulative course file. At present, 31 students are enrolled nation-



(ISIM). "New professions need an intellectual framework."

With that philosophy in mind, Boehm began ISIM as an online professional academy for future CIOs. ISIM, based in Irvine, Calif., offers courses and executive briefings electronically via its own network. With computers and modems, students and teachers can access ISIMNET 24 hours a day. The curriculum encompasses four areas of concentration: management of information; organization of information; policy issues of information management; and technologies of information.

Students receive study materials—books, floppy disks and articles—at the beginning of each course. Progress through the curriculum is self-paced. But, said Boehm, "This is not like a home-study

wide. On average, courses last 10 weeks and cost \$1,400 each, including all study materials and online fees.

ISIM offers individual courses, certificates and a structured graduate program leading to an MS Degree in Information Resources Management.

Boehm first developed the idea for ISIM while doing research at the Information Institute in Santa Barbara, Calif. In 1983, in the course of writing a book entitled *Education and Information Management*, he became convinced of the need to establish a structured educational program focusing on using and managing information technology.

With information management clearly taking on strategic dimensions in most organizations, Boehm said, "people must be prepared." ■

TRENDLINES

FAXTIDS

FAX IN A FLASH

Waiting for faxed information can be a little like waiting for water to boil—it never happens as quickly as you'd like. Of course, you can stand and watch water boil and estimate its progress. But you can only guess about the awaited fax: Is the sender out to lunch? Out of paper? Or have you simply been forgotten?

Nuntius Corp., a company in St. Charles, Mo., is taking the tending out of sending by enabling menus of documents to be faxed automatically—and immediately—at the recipient's request. Anyone with a pushbutton phone and a fax machine can retrieve documents 24 hours a day without requiring human assistance on the sending end.

Richard Shockey, president of Nuntius, is pushing the FaxBack system primarily as a tool for marketing communications and sales. "This society demands instant gratification," said Shockey. "Customers requesting price lists, product literature and reports don't want them tomorrow. They want them now."

Shockey is targeting the kinds of companies that traditionally get many requests for information from customers. "FaxBack can send financial reports, including graphics, and can replace [magazine] reader-response cards," Shockey said. "[The system] allows companies to respond to customer inquiries instantaneously."

Anyone requesting a specific document can dial the FaxBack number, select the desired document from a voice menu, punch in their own fax and phone numbers, and hang up. FaxBack will automatically

THE COMPUTER AS LIE DEFLECTOR

For those cynics who have always suspected that human behavior and ethics are driven more by fear, social pressure and other base forces than by anyone's innate "uprightness," there is new reason to be smug.

Research done recently at the Georgia Institute of Technology, in

Atlanta, suggests that people are less likely, in the course of a job interview, to lie to a computer than to another human being. The research found some degree of truth-stretching in all of the input methods it evaluated (friendly human interviews, unfriendly human interviews, pencil-and-paper questionnaires and computer interviews). But the computer encounters yielded the most honest responses.

Figuring out why is not a cut-and-dried matter, according to researcher Dennis Nagao, an assistant professor at the Georgia Tech College of Management. Among the possible causes of this new twist on user friendliness are the vulnerability of human interviewers to being fed what interviewees perceive they want



to hear. According to Nagao, human interviewers provoke "socially desirable" responses, in which job candidates seek to impress by exaggerating their qualifications and experience. Apparently, use of computers eliminates the social pressure of human interactions and leads to answers that are closer

to objective truth. After all, how do you "impress" a computer?

Nagao speculates that an additional inhibitor of prevarication could be the "Big Brother Effect"—the tendency of people to suppose that the computer they are interacting with is connected to a much bigger computer capable of instantaneously detecting a lie. The possibility of immediate detection throws cold water on even the most inventive deception.

The practical application of computer interviewing may be limited to use for lower-level hiring. The Georgia Tech researchers uncovered a tendency among those in line for management jobs to resent being interrogated by a computer.

send the requested information.

FaxBack works on a PBX or standard phone line and is single-line configurable. (A multiline version is now being developed.) Up to 10 directory files and 10,000 documents can be retrieved. Each outgoing transaction is recorded in a log that includes date, time, duration, fax number, phone number and the title of the document requested.

The \$5,500 price tag for a single-line configuration includes a fax board, voice card and all software. The 286- or 386-based PC required for the system is extra.

Even Las Vegas betting parlors have expressed interest in FaxBack, according to Shockey. "Someday, bettors may be able to get the latest point spreads on this week's games faxed to them." Now, this is progress.

ON THE RECORD

A computer has turned Luxembourg's Crown Prince Jean into an airplane.

The same machine made Jacques Delors, president of the European Community's central commission, an exhibitionist.

And it said that farmers across the continent have banded together to "screw the common agricultural policy" of the European common market.

These garblings were produced by the European Community's language translation computer, according to a recent article in *The Wall Street Journal*. The translator, created by the U.S. Navy 10 years ago, was supposed to help the EC commission cut its bureaucracy—half of which is devoted to language translation. But instead of costing human translators their jobs, it has given them a flood of malapropisms to clean up after.

For example, it changed Prince Jean's "nous avions" into "us airplanes," rather than the correct phrase, "we had." When Delors formally requested time to address a legislative committee, the system said the president wanted to "expose himself" to the lawmakers.

And when it tried to translate an agricultural policy tome's use of the idiom vis-a-vis, it came up with "live to screw."



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GOOD NEWS, BAD NEWS...

First the good news. A recent survey shows that top corporate executives think IS is doing a bang-up job. Now the bad news: We're not sure we believe them.

BY ALLAN E. ALTER

Last year, CIO commissioned Coopers & Lybrand, in New York, to conduct a study of the attitudes of non-IS senior executives toward information technology, and the role and performance of the CIO. Telephone interviews with 200 chief executive officers, chief operating officers and chief financial officers at Fortune 1000 companies were conducted last July. Re-

cently, Senior Editor Allan Alter and Managing Editor Lew McCreary discussed the findings with Michael W. Bealmear, partner in charge of planning in C&L's Computer Assistance Division; Ronald T. Brzezinski, a partner in the Strategic Systems Services Division; and Jacqueline E. Jeffrey, marketing director in the Management Consulting Services Division.

TOP CORPORATE EXECUTIVES—with the notable exception of chief financial officers (see related story, Page 28)—are taking a surprisingly rosy view of IS and CIOs. Is this good news for CIOs, or could it be a harbinger of trouble ahead?

That is the thorny question arising from a study commissioned by CIO and undertaken by Coopers & Lybrand. C&L's consultants found some of the revelations rather perplexing, when viewed from a CIO's perspective. "Many of the things that top executives are saying [in the survey] run counter to what a lot of CIOs feel," said Ronald Brzezinski, formerly the CIO at The Quaker Oats Company and now a partner in C&L's strategic IT practice. In short, said Brzezinski, some of "what I read in the survey doesn't intuitively make sense."

Despite what is widely perceived to be a climate of continuing uncertainty about the proper role and status of both IS and the CIO in many organizations, and despite a turnover rate for CIOs that some studies peg as high as 33 percent, the top executives surveyed in the C&L study expressed generally high levels of satisfaction with their companies' IS function and CIOs.

Approximately two-thirds of key executives (66 percent) stated that they were satisfied with their return on investment (ROI) in information technology. They cited cost-effectiveness, increased productivity, improved information flow and achievement of desired results as reasons for their satisfaction. The C&L team was astonished by these unexpected kudos for IS effectiveness and the high marks information technology received for ROI. Only 22 percent of respondents said they were dissatisfied with their return on investment. These executives complained that IT did not achieve the desired results, that it cost too much, or that implementation plans were poorly coordinated.

Also surprising to both Brzezinski and Michael Bealmear, partner in charge of planning in C&L's Computer Assistance Division, was that CEOs and COOs regard budget constraints and resistance from senior executives to be the two greatest barriers to CIO success. In their opinions, these factors outranked lack of business acumen and uncertain job expectations.

This suggests, said Brzezinski, that "CEOs do not feel they are spending too much money on IT—which really surprised me because of all the publicity about downsizing." Recognition that senior executives pose a barrier for CIOs was a "pleasant surprise," he continued. "But it also says that IS is going to need significant cooperation from the CEO and COO to effect organizational change. You are selling [IT] at a very senior level, [where there is] a lot more turf protection [to overcome]."

Areas of IT/CIO Effectiveness

	IT IS A SIGNIFICANT COMPONENT	CIO HAS BEEN EXTREMELY/ VERY EFFECTIVE
Improving productivity	91%	89%
Controlling costs	89	88
Creating/sustaining business advantage	81	73
Improving management effectiveness	80	75
Identifying technological opportunities	68	81
Managing technological risk	61	72
Facilitating/enabling organizational change	48	60

ALL CHARTS. COOPERS & LYBRAND 1989

Ratings for CIO effectiveness had a high correlation with the level of IT significance—the CIO was most effective in areas where IT was deemed most crucial.

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GKS	X	X			
Ethernet	X	X			
TCP/IP	X	X			
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SCSI	X	X			
VME	X				
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Executives were also asked how significant a role IT played in improving productivity, controlling costs, creating and sustaining business advantage and improving management effectiveness. Between 80 percent and 91 percent replied that IT played an extremely or very significant role in these areas. They also concurred, by similar numbers, that their CIOs had been extremely or very effective in obtaining these benefits. Yet only 56 per-

cent of respondents said that their company had a strategic mission statement that could serve as a guiding light for IS. Eighty-four percent of these executives felt their CIO was extremely or very effective in fulfilling their mission.

(It is important to note that many of the percentages given in the survey struck C&L's analysts as being quite high, in light of their experience with the IS world. Some of the figures will probably seem high to readers as well. In evaluating the survey as a whole, therefore, the results should be weighed not just individually, but also in relation to one another.)

"Why are [the respondents] so happy?" Brzezinski asked in discussing the survey.

Perhaps some respondents are truly and justifiably pleased with their CIOs. But it could also be that top executives are not telling the truth.

tions." In consumer products industries, for example, "marketing budgets have doubled or tripled in the past five years, whereas IS budgets have [only] gone up 20 or 30 percent," he said. "Maybe that's where the comparisons come."

In addition to their satisfaction with the IT investment—and perhaps because of it—the survey indicated that top executives now regard the CIO

as a key part of the general-management team—not a staff functionary with no shot at climbing the corporate ladder. Sixty-eight percent said they would consider the CIO for a line management position. "The survey shows that there's a lot of opportunity out there for the CIO for a broad management career," Brzezinski said. "Yet in actuality, the few that have broad management career opportunities are making news. And if senior management claims everything is fine, why is there so much turnover?"

The survey also found that most senior executives consider business strategy to be part of the CIO's role. Sixty-eight percent believe that the CIO should be extremely or very involved in the company's overall business strategy. But not all these executives have the

CFOs were less likely to meet with CIOs in person, one on one, than were CEOs or COOs. Non-manufacturing companies were most likely to have a formalized meeting structure.

Frequency and Type of CIO Interaction with Bosses

	TOTAL	TITLE			INDUSTRY	
		CEO	COO	CFO	MFG.	NON-MFG.
Formal meetings (e.g., staff/group meetings)	64%	64%	63%	64%	51%	72%
In-person/one-on-one	35	39	49	23	35	36
Phone calls	24	32	16	20	19	27
Memos/written records	9	7	14	7	4	12

Put another way, how do they know they're happy? "It gets into the MIS performance-measurement issues that have been around for the whole decade. They probably aren't measuring.

"I don't even know anyone who is measuring ROI effectively," he said. "I don't know how [top executives] can be pleased with ROI, other than that IS budgets have not increased as much as budgets for other func-

kind of CIO they want. When asked whether their CIOs were extremely or very involved in corporate strategy, only 76 percent of those who wanted a strategy-minded CIO said their IS chief met their expectations.

Furthermore, CEOs and COOs said that they or their designees meet with CIOs 11.1 times and 12.1 times a month, respectively. (CFOs only do so 7.9 times a month.) The consultants at C&L considered this to be a

startlingly high figure.

"[This doesn't jibe with] what I'm hearing on the street," said Brzezinski. "I just returned from a conference we sponsored in Canada. We had close to 70 CIOs there. A guest speaker brought up [the fact] that the CIO position is actually being downgraded in many organizations, and I think a lot of people agreed."

People don't usually invest time and money in a survey in order to dispute its results. But Brzezinski, Bealmear and Jacqueline Jeffrey considered these findings so counter-intuitively positive that the three had difficulty accepting them at face value. Perhaps some respondents are truly and justifiably pleased with their CIOs. But it could also be that top executives are not telling the truth.

"[CEOs may be] reluctant to say what they really feel because of peer pressure in the CEO ranks," said Brzezinski. "Everybody is jumping on the technology-as-a-competitive-tool bandwagon." CEOs answering the survey may not have wanted "to appear that [they're] not positioned to be competitive . . . and expose [that] vulnerability." Perhaps, too, ego

Who Does the CIO Report To?			
	TOTAL	MANUFACTURING	NON-MANUFACTURING
CEO	22%	22%	22%
CFO	18	25	12
President	17	10	21
Exec./Sr. VP	13	15	12
COO	8	1	12
Comptroller	5	10	2
Admin. Officer	4	4	5
Chairman	4	—	7
VP Finance	4	8	2
Other	5	5	5

got in the way of truth. Top executives may hold the view, said Jeffrey, that since they know how to run their companies, they therefore must be happy with the job their CIOs are doing.

The consultants concluded that many executives must be overly optimistic about IS performance and hold unrealistically high ex-

As reflected in reporting structure, non-manufacturing companies appear to value IT more highly than manufacturing companies by more often including the CIO in top management councils.



RONALD T. BRZEZINSKI, MICHAEL W. BEALMEAR and JACQUELINE E. JEFFREY: cautions amid the kudos

PHOTO BY ANDY FREEBERG

Barriers to CIO Success

	TOTAL	TITLE			INDUSTRY	
		CEO	COO	CFO	MFG.	NON-MFG.
Have Barriers	78%	72%	82%	82%	81%	77%
► Budget constraints	28	23	36	27	28	28
► Resistance by executives	22	27	16	20	35	13
► Uncertain job expectations	14	9	16	18	13	15
► Lack of business acumen	11	7	6	19	8	13
► Other barriers	6	8	8	1	1	8
No Barriers	22	28	18	18	19	23

CEOs show an awareness of the problem executive-level resistance poses to IS. They also appear to be ready to spend more on technology.

expectations for their CIOs. But how could they be so naive, especially if they are meeting so often with their CIOs?

There are a number of possible explanations. Thanks to executive information systems, Bealmear speculated, many CEOs and COOs are using computers themselves for the first time. "They have gone through this laborious and sometimes humiliating experience of learning how to push buttons," he said. As a result of this hands-on exposure to

Bealmear noted that 50 percent of the top executives surveyed had been in their current jobs for less than three years. "Maybe things were bad before, and [the CIO] is making some visible, short-term improvements, so [top management] are very happy executives." But if these improvements don't pan out over the long term, management won't stay happy—and the CIO might not stick around.

The C&L officials cited another perceptual clash raised by the study. Only 48 percent of the respondents considered IT to be a significant component in facilitating or enabling organizational change. And only 60 percent of those said that their CIOs had been extremely or very effective in this area.

"Most people in senior management don't really see the impact of organizational change already made, and continuing to be made, by CIOs," said Brzezinski. "They don't realize the organizational impact [of] a new customer-service or order-entry system. Every new system changes the way the organization works."

"There is a misunderstanding," said Brzezinski. "Yes, [senior executives] are more . . . supportive and knowledgeable [about technology], but they are still missing some key points." And Jeffrey observed that even though it is widely believed that American companies must overhaul the way they do business, management takes a less-than-rosy view of the CIO's ability to effect organizational change.

A provocative survey, like a children's story, leaves the reader with a moral or two. The main lesson emerging from this study, according to the group at Coopers

Top Information Executive in Company

	TOTAL	MANUFACTURING	NON-MANUFACTURING
VP IS/MIS/DP	39%	35%	41%
Dir./Mgr. MIS	24	30	20
Exec./Sr. VP	12	1	19
CFO	8	11	6
CIO	6	8	5
Other	10	12	9
Refused	1	3	—

Titles of IS function heads varied slightly between manufacturing and non-manufacturing companies, the major difference being a higher number of executive/senior VPs in non-manufacturing firms.

technology, "they may have a greater appreciation and respect for the CIO."

The same is true for executives who have just gone through a merger, acquisition or takeover situation. IS can look like a hero in a crisis just by supplying critically needed data. In an emergency, said Brzezinski, "a whole department can be perceived as a hero for coming up with a simple report."

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A Rock and a Hard Place

.....

The evolving role of IS in the organization puts inevitable strains on the relationship between those sometimes forced companions, CIOs and CFOs



The study of top non-IS executives conducted for *CIO* by Coopers & Lybrand sketches a somewhat ambivalent relationship between CIOs and CFOs. In a nutshell, according to the survey, the CFO is more likely than other members of upper management to regard the CIO as a techni-

cal specialist with a circumscribed role to play in the broad strategic life of the organization.

Unlike CEOs and COOs, the CFOs surveyed by C&L consider a lack of business acumen and uncertain job expectations to be significant barriers for CIOs, on a par with budget constraints and executive resistance. The survey found other indicators that CFOs hold a less exalted, more skeptical view of CIOs than do other top executives.

In terms of CIO qualifications, although all three executive categories agreed that mixed IT and management backgrounds were best, CFOs were more likely than either CEOs or COOs to look for candidates with a straight IT background: 20 percent, versus nine percent for CEOs and eight percent for COOs. Conversely, only three percent of CFOs valued management-only backgrounds, versus nine percent for CEOs and 14 percent for COOs.

Only 50 percent of CFOs said they would consider CIOs for a line-management position, compared with 77 percent for CEOs and 82 percent for COOs. All three categories of executives considered communications skills and management skills to be two of the top three important attributes for CIOs. But whereas CEOs and COOs named strategic vision and business acumen as the third top attribute, CFOs put technical skills in third place.

CFOs not only meet less often with CIOs than do CEOs or COOs; they are also less likely to meet with them in person or one-on-one. In short, CIOs who view CFOs as the spoilsports of the IS profession and as obstacles to a wider role for the CIO position can find evidence in the C&L survey.

"Misery loves company," said Michael Bealmear, partner in charge of planning in C&L's Computer Assistance Division. The CFO "is not going anywhere [in the corporate hierarchy]. He has no constituency, no

& Lybrand, is this: CIOs must take a close, skeptical look at how they and their IS departments are perceived by top executives.

If things are really rosy at their companies, congratulations. If not, Brzezinski and Bealmear advised, CIOs had better bring their bosses' expectations back to earth—before problems arise and optimism gives way to disappointment and frustration. Said Jeffrey, "What CIOs have to guard against is an ex-

pectation that they cannot fulfill." Said Brzezinski, "Maybe the CIO should pick this opportunity to yell, 'Hey, guys, things ain't as good as you think. Things are working now, but here are the pitfalls.'"

Perhaps, said Bealmear, CIOs should conduct a private inventory of key issues that could backfire, and make sure that they don't. Because if they do and the boss is surprised, their jobs will be in jeopardy.

empire. He is on a dotted line or a solid line off to the side of the chart, reporting directly to the COO or CEO. [He] has a small staff, isn't part of the line business, isn't considered to be a driver of the business, is viewed as necessary overhead.

"Where the CIO reports to the CFO, the IS function has exactly the same attribute" by association. Bealmear suggested that CFOs might be resentful because many have lost their power over IS, or are jealous of the new-found status of CIOs.

"Let me play devil's advocate," said Ronald Brzezinski, a partner in the Strategic Systems Services Division of C&L. "Maybe the CFOs are the only realistic ones in the bunch." According to Brzezinski, CFOs might have a valid point if their insistence on solid technology backgrounds reflects the view that the recent emphasis on non-technical skills could put companies at risk for a major systems snafu. Bealmear picked up the theme, saying that it is now commonplace to argue that "technical issues are not the real issues anymore," and that CIOs must have the business acumen to put technology in its proper context. "But frankly," he said, "I have not met too many CIOs who could do that."

CFOs may side with those who argue that no one person can master the intricacies of technology and business administration, and that CIOs should stick to technology, said Brzezinski.

He added that CFOs may have a "gut feeling that things have not been that rosy." Besides, in many companies, the CFO is ultimately responsible for the IS function and stands to be burned politically when a systems project goes off the rails. If a CFO has "seen mistake after mistake," said Brzezinski, he is likely to want to warn the CEO to "be cautious" and not let the CIO role stray too far from technology.

—A.E. Alter

One unsurprising trend reported in the study is the fact that executives in manufacturing firms tended to give lower grades and grant lesser status to CIOs than their brethren in non-manufacturing firms. Likewise, the top information executives in manufacturing firms tended to hold lower titles than those in service companies and reported more often to a financial officer. Only 62 percent (compared with 73 percent in non-manufacturing compa-

"What CIOs have to guard against is an expectation that they cannot fulfill."

—Jacqueline Jeffrey

nies) gave the opinion that the CIO should be extremely or very involved in the company's overall business strategy; and just 42 percent (62 percent in non-manufacturing companies) thought that the CIO actually was so involved. As for barriers to CIO success, top manufacturing executives said resistance by executives was the single biggest obstacle.

Preferred CIO Backgrounds

	TOTAL	CEO	COO	CFO
Both IT and general/line management background	77%	79%	76%	76%
IT background	13	9	8	20
General/line management background	8	9	14	3
Background doesn't matter	2	3	2	1
Would consider for a line management position	68	77	82	50

Brzezinski and Bealmear found this easy to explain. "That seems to support what's going on in practice," said Bealmear, adding that information technology is more important to non-manufacturers. "It's embedded in their products and services," he said. Conversely, while IT is helpful to manufacturers, it is not an actual part of the product. "That translates to the idea of where the CIO fits in the organization."

It was gratifying to come across at least one finding that could be easily explained. But clear explanations for the other responses will have to wait until next year. Coopers & Lybrand plans to make an annual habit of surveying CEOs, COOs and CFOs—and to pose some new questions that will delve deeper into the heart of this apparently untenable happiness. ☐☐

While all three categories of non-IS executives regarded a mixed IT and general-management background as highly useful in CIO candidates, CFOs placed a higher emphasis on pure technology skills and less on pure management skills.



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Meet five CEOs
who value a
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foundation.

CORNERSTONES

BY DAVID FREEDMAN

FOR THE PAST THREE DECADES, information technology has been struggling to make the transformation from necessary evil to strategic weapon. CIOs, consultants, journalists and business school professors can make pronouncements about the success of this transformation until they are blue in the face, but the obvious truth is that none of this can happen unless it first happens in the eye of the CEO.

Where, then, does the CEO stand? In many different places, of course, depending not only on the individual CEO, but also on the industry, the size of the company, the corporate culture and many other variables. But if there is no one answer, there does seem to be a trend, and it is an encouraging one—at least to judge by the conversations we recently had with five CEOs.

CHARLES BLAUER: *going beyond CIM
to add value for customers*



Granted, these five CEOs may not precisely typify U.S. corporate leadership with regard to IT. For one thing, the five have CIOs (in function if not in title) who report directly to them—a situation that may suggest their organizations are at least a bit in front of the curve when it comes to being IT-savvy. On the other hand, we're not talking about American Airlines or American Hospital Supply either (no doubt to the readers' great relief). The five CEOs we spoke with are Tom Epley of The Bekins Company, a nationwide moving and storage company based in Glendale, Calif.; Bill Blundell of General Electric Canada Inc. in Mississauga, Ontario; Norman Phelps of National Liberty Corp. in Frazer, Pa.; Dick Cooley of Seattle-based Seafirst Bank and Charles Blauer of clothing manufacturer Blauer Inc. in Boston.

All five of these CEOs have a familiarity with IT issues that goes beyond the standard drivel about competitive edges and strategic weapons. They have clearly spent a significant amount of time thinking about the impact IT can have on their organizations, and what steps should be taken to harness this impact to their benefit. In short, IT has become something that the CEO worries about.

CEOs have little choice in the matter, according to GE Canada's Blundell. In constantly examining the performances of his company's many subsidiaries, he has noticed a telling IT-related pattern. "The companies that have had operating problems and have fallen behind are the ones that haven't kept up with information technology," he said. "In the future, information technology will be even more critical, and companies will be reaching a point of no return."

Blundell has taken personal responsibility for ensuring that GE



NORMAN PHELPS: Increasingly, CEOs are involving themselves in technology decision-making.

Canada makes it safely past this point. "At the beginning of the year I list between six and eight priorities that I want to see achievement on," he said. "Information technology has been on that short list for the past several years."

Bekins' Epley, who has managed the restructuring of several businesses as a senior manager for corporate raider Irwin Jacobs, has noticed the pattern too. "I always look for the key things we can utilize that the competition hasn't," he explained. "Information management is one of those key factors. Over the years I've found it to be one of the worst-managed key elements of any company."

One of Epley's criticisms of the way organizations manage information technology is the fact that the top IT manager is usually in a staff

role. "The further you get from the people who have control of the operations of the company on a daily basis, the less impact you have," he said. "I've tried to make information management a line position to the greatest degree possible."

Epley seems to know exactly what he wants to accomplish through IT. "We're using it not only to gain competitive advantage and reduce costs, but also to reduce our error rates, [which is] one of the areas whose tremendous impact is often overlooked," he said. "When you avoid the problems caused by having to fix things that weren't done right the first time, you provide people with the opportunity to solve [business] problems rather than having to struggle to keep up with the clutter of bad information." Epley can describe in detail how Bekins cut down the num-

ber of errors involved in the moving process by integrating its order-entry, tracking and invoicing systems.

Even Blauer Inc., though tiny compared to companies like GE Can-

"I always look for the key things we can utilize that the competition hasn't. Information management is one of those key factors. Over the years I've found it to be one of the worst-managed key elements of any company."
—Tom Epley

ada and Bekins, has embraced an IT-dependent strategy, according to CEO Charles Blauer. The company has already set up a computer-integrated manufacturing system that allows it to almost instantly customize any of a number of standard designs and turn the designs into finished clothing. Blauer shudders at the thought of returning to the company's pre-CIM days. "If we had to go back to the manual way of doing things, we'd be submerged," he said. "Now we're thinking of ways we can have our computers make our customers more competitive, like having them access our inventory files and enter in specifications so they can quickly respond to a bidding opportunity."

Another point of agreement between the five CEOs: If IT is to play a strategic role, the CIO must report directly to the CEO. (For a different point of view, see "When the CFO is Boss," Page 35.)

"Information technology is ex-

When the CFO Is Boss

It has become a reflex to insist that the CIO be freed from control by the finance function, but some companies' CIO-CFO teams are thriving

Sara Lee Corp. comprises some 50 companies that make products ranging from cheesecake to pantyhose. At all but a handful of these companies—and at the Chicago corporate headquarters—the top



CFO MICHAEL MURPHY: *Not everyone can report to the CEO.*

IS manager reports to the chief financial officer.

Is that really so bad?

Not if the CFO is well-informed, according to Michael Murphy, executive vice president, chief administrative officer and CFO at Sara Lee headquarters. "The CFO better have a sense of how information systems can be strategic," he said. "At Sara Lee, all our senior management is very sensitive to the need for timely and accurate information

as a vehicle to running the business more effectively."

Murphy insists that having IS report to the CFO is not a slight, but simply reflects an effort to keep the CEO from being swamped. "I know CIOs think they should report to the CEO, but so does the head of public relations," he said. "Every functional area has that same belief. But most CEOs can only have so many people reporting to them before they have to cut back due to a limited span of control."

Vice President of Corporate Systems Vincent Swoyer isn't complaining. "Mike isn't just a financial person," he said. "He sits on the CEO's staff and spends most of his time dealing with operating and non-financial decisions." When a large project comes up, Swoyer said, he and Murphy go to the chief operating officer with a proposal, and if the three of them agree on its merits, the proposal then goes to the CEO. It's an involved process, he conceded, but it only applies to about six projects a year; the hundreds of smaller projects that come up can be approved by Murphy alone.

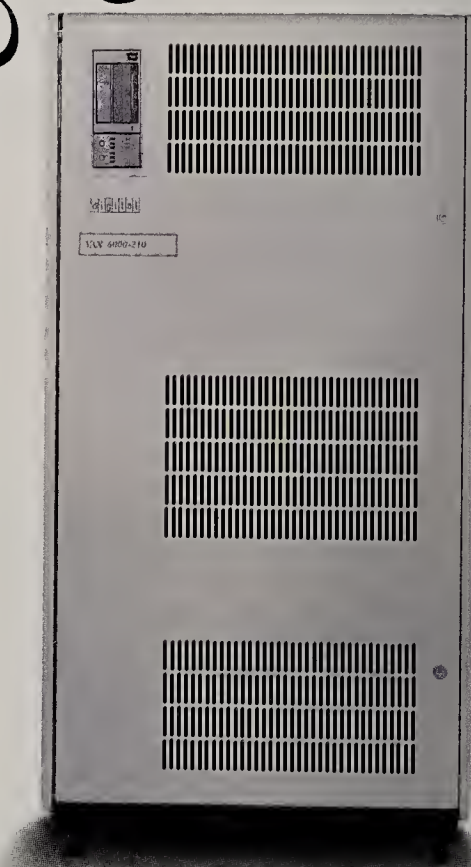
Even Murphy, however, acknowledges that in a growing number of companies it makes sense for the CIO to report to the CEO.

That's the case at Sara Lee subsidiary Hanes Hosiery Inc., where a state-of-the-art distribution system is widely credited with helping the company stay ahead of its competition. "It's changing," Murphy said. "With all the consolidation of businesses going on, MIS has more responsibility. Ten years ago there were no cases here of a CIO reporting to a president, but now we're seeing it happen at more of our divisions."

—D. Freedman

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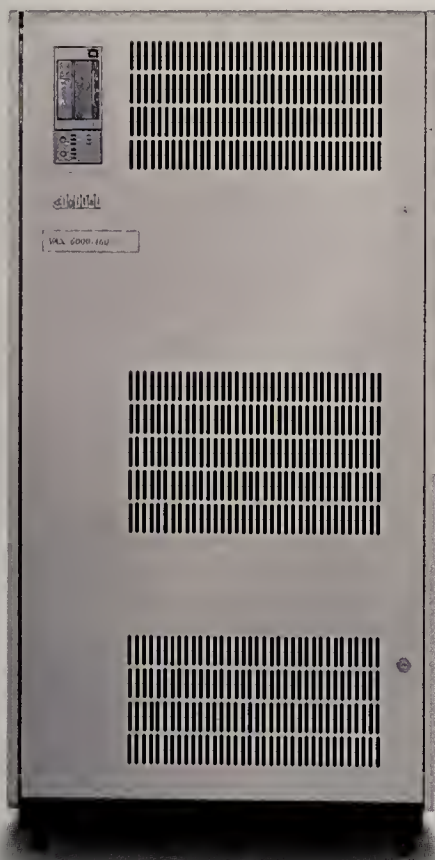
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tremely important to the banking business," said Seafirst CEO Cooley, "and that importance is increasing. I don't know much about the technology itself, but I know that it's too important for me to not be directly involved in the decision-making." Even if the CEO doesn't personally contribute a great deal to the IT planning process, Cooley believes, his or her involvement is critical to IT's acceptance in the organization. "If the CEO isn't in on it, people won't take it seriously," he said.

Epley insists that having the CIO report to the CFO is an anachronism. "The function grew up in accounting because it used to be an accounting entity," he said. "If that's still the only issue facing a company, then that's where it should stay. Otherwise, there is no more reason to have the CIO report to the CFO than there is to have the COO report to the CEO."

Even though most CEOs don't

have the IT function report directly to them now, according to National Liberty's Phelps, they probably will within a few years. "Most CEOs are becoming involved in information-management issues," he said. "That wasn't the case five years ago, but now it's hard to talk to a consultant without hearing that the use of IT is [the] key to success or failure."

Phelps maintains that the main role of the CEO in the IS management process is to keep the IS goals in line with the business goals. "I try to make sure our strategic planning and our information systems planning are plugged together well," he explained. "The CEO has to establish the value of IT to the particular industry you're in and then establish the priorities and allocate the resources that will take you where you want to go."

To accomplish all this, Phelps meets regularly with his CIO, Vice President of Information Services and Marketing Operations Peter Cola,

both in informal, private talks and in scheduled staff meetings. Phelps has also made Cola part of the company's strategic planning committee, where the formal decisions about priorities are made. But exactly how a CEO goes about participating in the IT decision-making process isn't important, said Phelps, as long as the participation is there. "We have an open culture that's oriented to teamwork, but that might not be the right way to do it in a different company or industry," he cautioned. "The important thing is to recognize the CEO's and [the] company's own unique

"I don't know much about the technology itself, but I know that it's too important for me to not be directly involved in the decision-making."

—Dick Cooley



BILL BLUNDELL: IT has been on the CEO's short list of priorities for several years.

styles, and then to find the best way of getting your goals accomplished."

GE Canada's Blundell noted that with 13 direct reports, it would be difficult for him to spend a lot of time with CIO Geoffrey Relph—or any other executive, for that matter. "I don't get to talk to him every week," he said. What he does do, however, is make sure that Relph participates with him in all major strategy meetings, including those of the elite Corporate Committee. "We work hard to make sure Geoff is current on all the operating problems of the business; that's why we made him a full-status member of the council," he said. "After we formulate the plans at these meetings, we look to Geoff to implement them. All I ask for after that from Geoff is an occasional review of the progress he's made."

One responsibility these CEOs all

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share is assessing the business value of proposed IT plans. "My involvement is [in] understanding what they want to do," said Seafirst's Cooley, "and then making sure the technology makes sense economically. I don't need to have the latest laser beam if it doesn't pay us to do it."

Cooley has institutionalized his definition of what pays and what doesn't: If Seafirst's CIO, Executive Vice President and Manager of Operations Group Timothy Turnpaugh, can't make a convincing case that an IT investment will return every penny within 18 months, Cooley doesn't

want to know about it. Turnpaugh hasn't let him down. "He's always trying to make money for the company," said Cooley with satisfaction. "That's the attitude I like."

Some IS managers might cringe at this sort of tight business justification policy, but Cooley can offer convinc-

What the CIO Thinks About the CEO

.....
After winning regular access, the trick is using it effectively

In addition to speaking with the CEOs of The Bekins Company in Glendale, Calif.; General Electric Canada Inc. in Mississauga, Ontario; National Liberty Corp. in Frazer, Pa.; Seafirst Bank in Seattle; and Blauer Inc. in Boston (see main story); we also talked to the CIOs at these companies. All were emphatic about the importance of the CEO to IT success.

To start with, all felt strongly that the CIO should have regular access to the CEO. "It's the first battle to win," said GE Canada CIO Geoffrey Relph. "If you're not rubbing elbows with the CEO and other senior managers on a regular basis, you'll be severely hampered in your effectiveness."

Bekins Vice President and CIO Larry Marzullo was equally adamant. "It's been very rewarding to have that give and take with [CEO Tom Epley]," he said. "If you have to go through levels of management, the CEO won't understand the impact of what you're doing."

Marzullo said that Epley's in-

volvement and support have been critical to his company's IT efforts. "He is a kind of coach," Marzullo said. "He truly believes that information systems have to be a key part of things. He also forces us to

case that way to [CEO Dick Cooley] in plain English, he'll tell me to go whistle. What's the difference in the decision-making process between investing in more workstations or investing in a new branch?"



CHARLES and son MICHAEL BLAUER: winning approval either before or after

be involved in the business every day." That involvement even includes bringing in IS managers to help analyze claim disputes resulting from breakage or loss during a move, he noted.

Executive Vice President and Manager of Operations Group (and CIO by function) Timothy Turnpaugh at Seafirst Bank pointed out the value of having the CEO bring IT into the mainstream business environment. "I've never viewed myself as a technologist," he said. "I'm a businessman that just wandered into technology. If I don't make my

Blauer's CIO also has to present a business case to the CEO, but he has one advantage over the others: He is the CEO's son. "Sometimes my father doesn't see the same value in certain things that I do," said Vice President Michael Blauer, who handles other roles besides the functional one of CIO, "but if I map it properly to show the return on investment he usually approves. If he doesn't approve, sometimes I go ahead and do it anyway and hope he sees the value in the end." Just try getting away with that.

—D. Freedman

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ing evidence that it stimulates rather than suppresses IT innovation. He described, for example, how his bank was able to provide some unique offerings: a one-year CD whose price was adjusted quarterly to follow treasury bills, and attractively priced financial instruments available only on Saturdays to capture customers who are busy during the week. These IT-dependent products were hits, and it took competitors a year or more to build the systems needed to duplicate them. "We added millions of dollars

we want to be today," said National Liberty's Phelps. "It's easy to say that IT should be viewed as a strategic weapon, but the hard work is turning that into something real."

Phelps said that the process of developing IT programs must pay off in more than successful computer systems. "We're learning that when you think about automating a piece of your company," he explained, "you have to rethink your ways of doing things—and not just about how to automate something that you're do-



TOM EPLEY: seeking impact on information technology decisions by maintaining contact

in new money because no one could do what we could do with our computers," Cooley boasted.

Most CIOs are by now well-tuned to the demand for demonstrable business value, but the CEO and CIO may not always agree on how to assess values and risks. Not surprisingly, it is generally the CEO's opinion that holds sway. "We had quite a battle over whether to set up a PC-based local-area network," recalled Blauer. "Michael [Blauer, CEO Blauer's son] really wanted the LAN, but after a lot of tossing back and forth I decided that it would be premature for us."

Although few CEOs would question the basic value of IT in their organizations, some are candid in assessing the success with which it has been implemented. "We're not where

ing now. We're using IT as a way of restructuring the company."

Bekins' Epley noted that IT has paid off in different ways in different parts of the company. In the company's "high-value products" group, for example, which specializes in shipping sensitive equipment, a state-of-the-art tracking system has improved market share. But that type of dramatic payoff is the exception. "In other business areas information technology has been more of an internal tool to which it would be very difficult to ascribe a market share improvement," he said. "But that doesn't mean it doesn't help us establish a competitive edge."

Epley insists that most of the key IS projects he wanted have been completed. But he's not ready to proclaim everything a success yet.

"If we had to go back to the manual way of doing things, we'd be submerged. Now we're thinking of ways we can have our computers make our customers more competitive, like having them access our inventory files and enter in specifications so they can quickly respond to a bidding opportunity."

—Charles Blauer

"Once you reach your objectives, you should be willing to slow down and fine-tune things," he said. "We're now in the process of evolving from a development mode in information technology to a tactical, operational mode. We want to get everyone to understand the tools we've put in place, and to fully utilize them."

Achieving success with IT can require a great deal of patience and commitment from the CEO, pointed out GE Canada's Blundell. It also often requires an initial leap of faith. "Eventually, you have to demand enough measurable achievement both to provide encouragement and to generate the margins to reinvest in other projects," he said. "But first you need to put in a critical mass of resources to build momentum. If you [don't] put in the resources up front, you won't get anywhere." ☐

David Freedman is a freelance writer based in Brookline, Mass.



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In computer languages, talk is anything but cheap and fluency is for programmers only. But 4GLs turn economy of expression into a competitive virtue and take some of the mystery out of mastery

BREAKING THE LANGUAGE

BY MICKEY WILLIAMSON AND
NINAMARY BUBA MAGINNIS



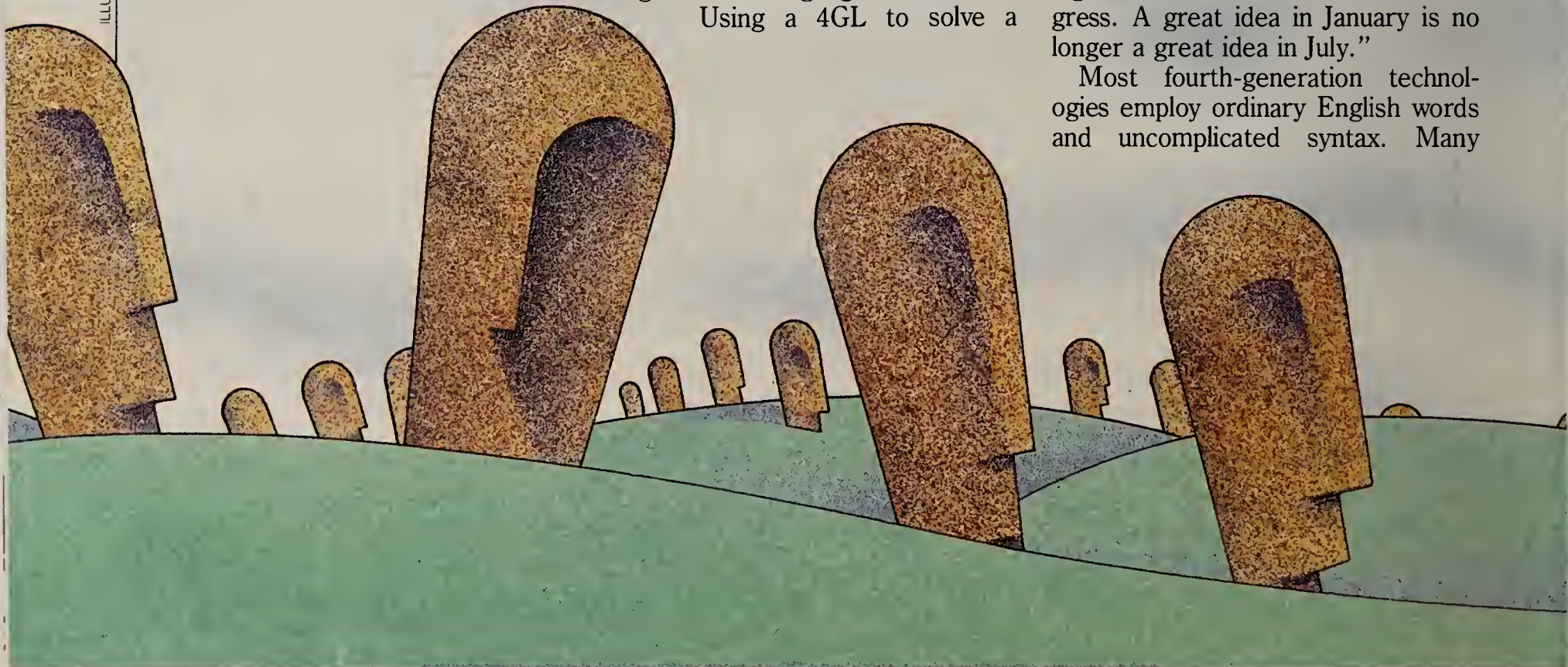
Like most new technologies, fourth-generation languages hold many promises. According to a common rule of thumb among information systems professionals, the same procedure that requires 10 lines of code in a conventional third-generation language such as COBOL or FORTRAN can be written in a single line of a fourth-generation language, or 4GL.

Using a 4GL to solve a

business problem can turn a six-month application-development process into a one-week project, according to Hugo Simpson, vice president of information and productivity systems at Unisys Corp. of Blue Bell, Pa. "The benefit is [that] you can do something quickly," he said. "And if you don't do it quickly, you may not do it at all. The stock market crashes, the interest rate goes up, a new legislative rule comes out of Congress. A great idea in January is no longer a great idea in July."

Most fourth-generation technologies employ ordinary English words and uncomplicated syntax. Many

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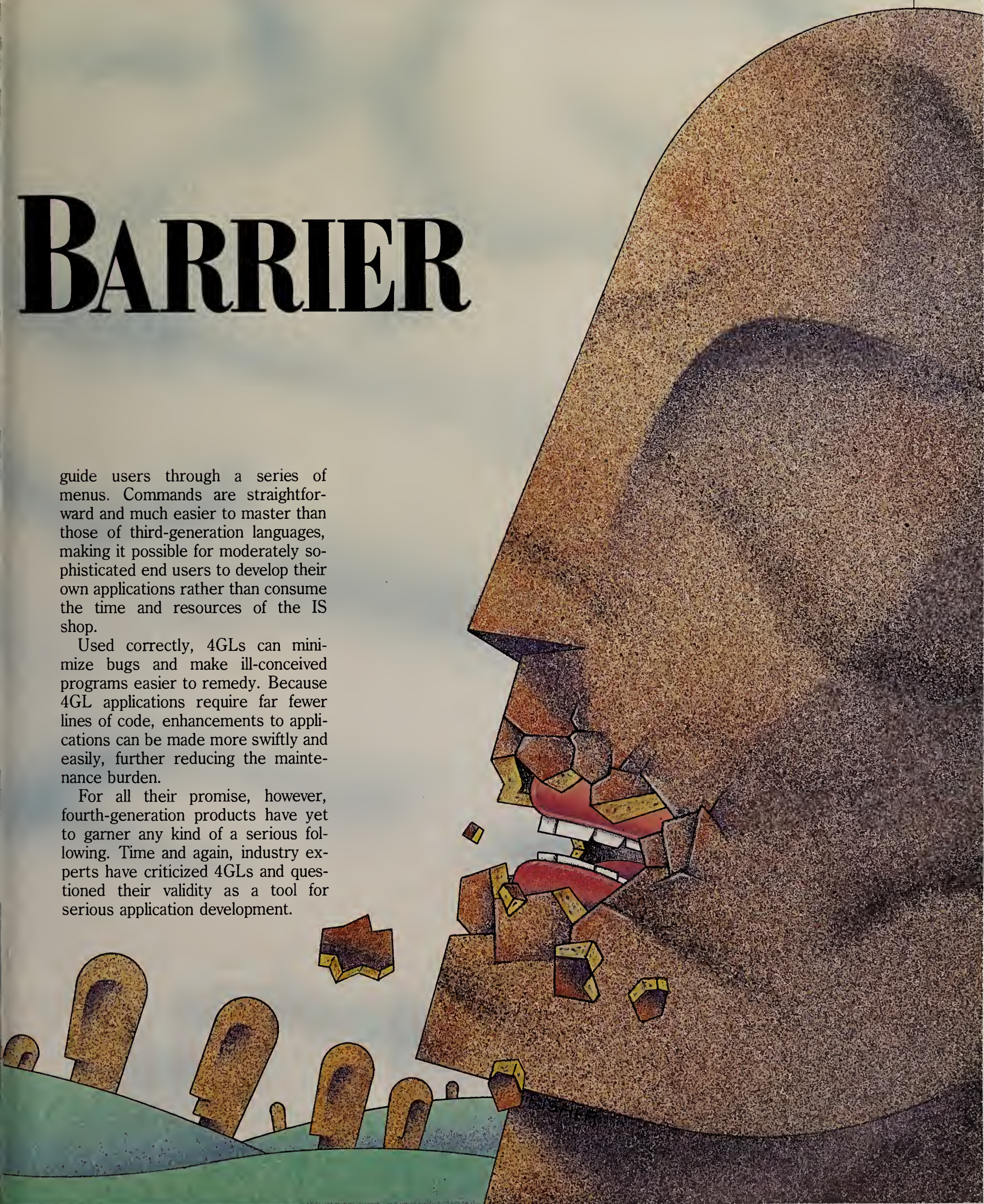


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guide users through a series of menus. Commands are straightforward and much easier to master than those of third-generation languages, making it possible for moderately sophisticated end users to develop their own applications rather than consume the time and resources of the IS shop.

Used correctly, 4GLs can minimize bugs and make ill-conceived programs easier to remedy. Because 4GL applications require far fewer lines of code, enhancements to applications can be made more swiftly and easily, further reducing the maintenance burden.

For all their promise, however, fourth-generation products have yet to garner any kind of a serious following. Time and again, industry experts have criticized 4GLs and questioned their validity as a tool for serious application development.



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To gain the most benefit from a fourth-generation technology, programmers must learn the new language inside out. "I'm not a big proponent of 4GLs," said Victor Carr, a computer consultant with Computer Help in Framingham, Mass., a generalized consulting firm specializing in custom software. "If you're going to do anything sophisticated, you've got to be as much of a programmer in a 4GL as you are in a third-generation language."

According to Carma McClure, vice president of Extended Intelligence Inc., a Chicago-based consultancy for computer-aided software engineering (CASE), fourth-generation languages will have to blend into CASE products if they are to survive the next decade.

CASE and fourth-generation technology seem made for one another. Both address different parts of the application life cycle, noted Vaughan Merlyn, chairman of CASE Research Corp., an independent consulting firm in Bellevue, Wash. The life cycle starts with strategic planning and systems analysis, moves to application design and programming, then ends with testing, installation and maintenance.

"CASE tends to address the early part of the application life cycle, and [to] address that very well," said Merlyn. "Fourth-generation languages address the middle part—and they address it very, very well." Even though many CASE vendors are hooking into COBOL code generators, there is still a market for 4GL code generators. "It is an accident of fate that when CASE vendors tried to drive further into the life cycle, they chose to do so with COBOL generators," Merlyn said.

In the debate over the future roles of third- and fourth-generation languages, McClure contends that COBOL will most likely remain the major player. "COBOL can handle bigger business applications, and 4GLs are somewhat limited," she said. Yet Merlyn predicts that fourth-generation languages will hold their ground, while some will infiltrate fur-

"One of the real keys to some 4GLs is [that] they are very portable. You can generate a program on one platform and move to another with no problem at all. And you can have the two platforms interchanging and talking to one another."

—Herb Gepner



ther into larger organizations. "Certain 4GLs on the market outperform COBOL," he said.

For example, many fourth-generation products can run unchanged on several hardware platforms—an important consideration in multivendor environments. According to Herb Gepner, senior associate editor for Datapro, a publisher and information-processing market-research company based in Delran, N.J., "One of the real keys to some 4GLs is [that] they are very portable. You can generate a program on one platform and move to another platform with no problem at all. And you can have the two platforms interchanging and talking to one another."

COBOL, on the other hand, is not so versatile. "COBOL is one of the least portable languages there is,"

said Merlyn. "It was defined years ago and is deficient. It's not a complete language. It doesn't deal with data access or teleprocessing." To compensate, programmers must build extensions to COBOL that "tend to be [hardware-]specific . . . so they're not portable," he explained.

According to Merlyn, CASE tools, COBOL generators and fourth-generation languages will work together to solve automation problems. "That's why the debate is going on without resolution," he said. "It's a non-issue. Successful shops will use a mix of strategies as they continue to upgrade their development processes."

Ever since they were introduced, fourth-generation languages have suffered an identity crisis. Every vendor, consultant and programmer has a different definition of the technology.

According to James Martin, a well-known industry expert and the author of *Fourth-Generation Languages, Volume I: Principles*, the term implies a faster, higher-level approach to telling computers what to do. In Martin's text, computing's fourth generation encompasses both procedural and nonprocedural languages, code generators, report writers, query languages and application generators.

All of those technologies are a far cry from the 1950s, when developers wrote computer instructions in binary, or machine, code. A misplaced one or zero could wreak havoc on a computer program. To make application development easier to debug, a second-generation instruction set, assembly language, was developed in the mid-1950s and used extensively for about 10 years.

Then in the early 1960s, high-level third-generation languages such as FORTRAN, BASIC and COBOL were introduced. Although programming became easier, application developers still had to have extensive education and training before they could master the process. Not long

after that, vendors began marketing productivity tools that offered a more intuitive approach to programming.

In the late 1960s, one of the first such productivity enhancers hit the marketplace: RAMIS (Rapid Access Management Information System), now supplied by On-Line Software International Inc. of Fort Lee, N.J. Specializing in IBM environments, RAMIS gives end users menu-driven report writers. "We're the end users' 4GL," said Doug McCartney, On-Line's product marketing manager. "RAMIS is nothing more than a facili-

"A fourth-generation language means fewer instructions done at a higher level. One statement can replace many third-generation statements."

—Lloyd Erickson



tator between the mainframe and PC, between the user and his or her data."

Such menu-driven tools, however, are not languages in the true sense of the word. Although menu-based systems enable end users to instruct the computer to perform certain tasks, they lack the flexibility and power of language statements. Thus, different 4GLs are appropriate for different classes of users. In fact, some observers see a 4GL marketplace made up of two distinct hemispheres. Said Lori Weitz, systems and applications

vice president for Mathtech Inc., an independent consulting firm in Princeton, N.J., "I do see the world as [containing] programmer 4GLs and end-user 4GLs."

According to Weitz, programmer 4GLs are procedural languages—such as NATURAL, from Software AG of North America in Reston, Va., and MANTIS, from Cincinnati-based Cincom Systems Inc. The programmer tells the computer what to do and how to do it. End-user 4GLs, on the other hand, are nonprocedural. The user simply commands the computer to perform a task and the system decides how best to complete it. Because programmer 4GLs are more complex, they tend to run more efficiently. "Programmer 4GLs have more horsepower than end-user 4GLs," Weitz noted.

At Unisys, the world is truly split in two. The firm offers experienced programmers LINC, a powerful

fourth-generation language that can build large corporate mission-critical systems, according to Simpson. Another product, MAPPER, is designed to complement LINC. "The magic of MAPPER is [that] people who are literally end users of the business can easily construct their own systems—with some complexity as well, depending on their ambition," he said.

Unlike most programmer 4GLs, LINC generates programs in COBOL. That feature, however, represents more of a marketing decision than a technical one. "We decided to go through COBOL to make people feel comfortable," Simpson said. "If everything else failed, they could go in and have a look at it. I personally see no value of going through COBOL other than to reassure the 3GL world that there is something there [that] they recognize."

Yet, to programmers, true fourth-generation languages resemble their

Selected Fourth-Generation Languages

COMPANY	LOCATION/PHONE	PRODUCT NAME
Cincom Systems Inc.	Cincinnati 513 662-2300	MANTIS
Clarion Software Corp.	Pompano Beach, Fla. 305 785-4555	Clarion Professional Developer
Information Builders Inc.	New York 212 736-4433	FOCUS
Informix Software Inc.	Menlo Park, Calif. 415 926-6300	Informix-4GL Rapid Development System
Microrim Inc.	Redmond, Wash. 206 885-2000	R:BASE
MUST Software International	Norwalk, Conn. 203 845-5000	NOMAD
On-Line Software International	Fort Lee, N.J. 201 592-0009	RAMIS
Oracle Corp.	Belmont, Calif. 415 598-8000	ORACLE
Software AG of North America	Reston, Va. 703 860-5050	NATURAL
Unisys Corp.	Blue Bell, Pa. 215 542-4420	LINC; MAPPER
SOURCE: THE QWERTY GROUP		

third-generation predecessors, according to Lloyd Erickson, an engineer at the Johnson Space Center in Houston (see related story, Page 56). "A language should have a lot of logical constructs like IF . . . THEN, [and] GO TO, so that you can actually make the machine follow certain instructions," he said. "A fourth-generation language means fewer instructions done at a higher level. One statement can replace many third-generation statements." Erickson uses NOMAD, a fourth-generation language from MUST Software International of Norwalk, Conn.

Unfortunately, the very power fourth-generation language statements are blessed with can create problems. One common complaint, for instance, is that 4GLs do not use computer resources as efficiently as third-generation languages. With third-generation programs, every statement performs a small and specific task. In contrast, fourth-generation statements imply many tasks.

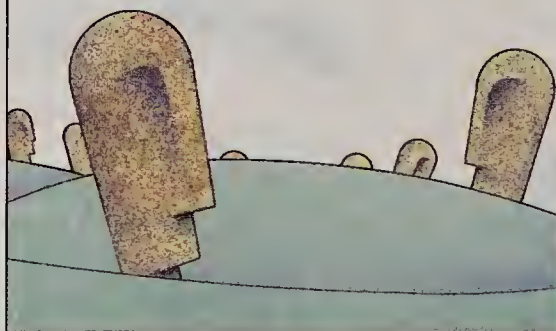
"There is also more than one way to make something happen," said Erickson. "But it's not obvious to the programmer, unless he's very experienced, which method is most efficient for a particular task. Therefore, it's easy to abuse a 4GL."

Another reason for inefficiency is that some fourth-generation products are interpreted, rather than compiled. Ultimately, all programs must be compiled into symbols that the computer's circuitry can understand. Compiled programs are converted into machine-readable symbols once and stored that way. Interpreted programs do the compilation each time the program is run, requiring extra processing power to get the job done, Erickson explained.

Some implementation consultants actually prefer older, more time-consuming methods over the faster, fourth-generation tools. When programming microcomputers, Carr has worked with R:BASE, a fourth-generation language from Microrim Inc. of Redmond, Wash., and dBASE,

As with any new skill, practice with a 4GL makes perfect. "You become more proficient. I'm able to create applications now that I wouldn't [have] dreamed of doing two years ago."

—David Blocker



from Ashton-Tate Corp. of Torrance, Calif., but he prefers a 3GL called MUMPS. Both R:BASE and dBASE establish fixed-length fields for records, said Carr. "If a field is empty, you're still using up that much space, even if there's no data in it. With MUMPS, if there's no information for that field, you can, in fact, save all but one of the bytes for storage capacity."

One feature of fourth-generation tools that Carr does like is that they enable nonprogrammers to query sophisticated databases—up to a certain point. "But once you get beyond simple query applications," he said, "it breaks down and you have to go into a query environment where the inquiring capacity is more powerful, more complex. Therefore, you're back into programming and you end up with a programming staff doing the work again."

As with any new skill, practice with a 4GL makes perfect. Application developers who carefully study a fourth-generation product tend to write more efficient programs, ac-

cording to David Blocker, a consultant and trainer based in Sharon, Mass. "It gets better all the time," reported Blocker, who specializes in Microrim's R:BASE. "You become more sophisticated and more proficient. I'm able to create applications now that I wouldn't [have] dream[ed] of doing two years ago."

Most 4GL vendors recognize that different users require different tools. They offer programming professionals more powerful development tools while designing more straightforward query facilities and report writers for end-users. "R:BASE has evolved simultaneously in two directions," said Blocker. "At once they've attempted to bring much more power to the casual user as they've increased the power of the serious developer."

In the choice between conventional programming languages and 4GLs, there are no easy answers. As CASE Research's Merlyn observed, "4GL horror stories tend to proliferate—and people [rarely] ask what was underneath the horror stories. We tend to look for easy, silver-bullet solutions. And, when that doesn't work, we tend to look for easy, silver-bullet problems to blame them on. Life doesn't work that way."

The only way to succeed with fourth-generation technology is to choose a product that fits, and then work to master it. "One reason why people are not that happy with 4GLs is that their expectations were wrong," said Mathtech's Weitz. "They thought that fourth-generation languages could do everything. You can get enormous productivity gains with 4GLs, but you have to know where and how to apply them."

NATURAL, for example, was designed specifically as a COBOL replacement, said Tim Wild, Software AG's product marketing vice president. In fact, some customers do choose to forego COBOL and develop all new applications in NATURAL. At Jones Truck Lines Inc., a Springdale, Ark., regional trucking firm,

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NATURAL practically replaced COBOL in October 1987, said Mick Crowder, the firm's vice president of administration. "Ninety-five percent of our applications are in the NATURAL environment," said Crowder. With it, the trucking firm's programmers have developed high-volume transaction-based applications that cope with some 300,000 online transactions each day. After running benchmarks, the company's IS professionals reported the 4GL performed as well as COBOL.

"We were prepared, if necessary, to back off to COBOL—or assembler—to handle parts of the system that were CPU-intensive," noted Crowder. But that turned out to be unnecessary. "As long as you don't write really large programs, [and] as long as you look at the transactions and modularize the approach, we have found [the 4GL to be] extremely flexible and straightforward."

At their best, fourth-generation languages enable developers to con-

centrate on the business problem, not the coding. For Clement Kichuk, president of MarketCorp Systems Inc., a software consulting house in Westport, Conn., the 4GL of choice is PACE, a fourth-generation professional application-development environment from Wang Laboratories Inc. of Lowell, Mass.

"From an information-modeling point of view, we understand how information flows within our clients' businesses," said Kichuk, who also serves as vice president of MIS for Marketing Corp. of America, MarketCorp's parent firm. "With PACE, you can describe relationships and the referential integrity you want imposed at all times," he explained. Referential integrity refers to a method of protecting records in a relational database from corruption by controlling access to them. "Once you've done that, you're finished," he said. "You never have to code it again. Everyone using that database uses the same data dictionary and is constrained by the same rules."

As users look for faster ways to program, they should carefully evaluate potential products, cautioned Jim Geary, director of marketing for CompuServe Data Technologies in Cambridge, Mass. (CDT is a division of CompuServe Inc. in Columbus, Ohio.) "You've got to look at the application problem you're solving from a systems perspective," said Geary, whose firm sells System 1032, a fourth-generation language that runs exclusively on Digital Equipment Corp. VAX computers.

Geary recommends testing the software in-house to gain an understanding of how it works before committing to it. "You have to look past a lot of the smoke," he said.

As vendors push fourth-generation technology further, users will see expert systems and knowledge-based repositories become part of application development. Some fourth-generation languages—FOCUS, from New York-based Information Builders Inc., and Wang's PACE among them—are already beginning to exploit the power expert systems can

After developing systems in a fourth-generation language, many can no longer conceive of working only in third-generation environments.



"We tend to look for easy, silver-bullet solutions. And, when that doesn't work, we tend to look for easy, silver-bullet problems to blame them on. Life doesn't work that way."

—Vaughan Merlyn



bring, according to both vendors.

Perhaps one day computer programming will be so intuitive that even the most naive users will be able to tell the machines what to do. In the meantime, when users move to fourth-generation languages they must invest time and money to learn the best way to use the newer technology. Working with a skilled consultant on the first development project can help full-time staff members understand a 4GL's nuances and power, said MarketCorp's Kichuk. "That can be the best money any company can spend," he noted.

After developing systems in a fourth-generation language, Kichuk can no longer conceive of working only in third-generation environments. "When all people had was the shovel, would they ever dream the Panama Canal was possible? Giving people the steam shovel changed the horizons of their ambitions." □

Mickey Williamson heads the Querty Group, technical journalists based in Warwick, Mass., and edits the newsletter CASE Strategies. Ninamary Buba Maginnis is a member of the Querty Group.

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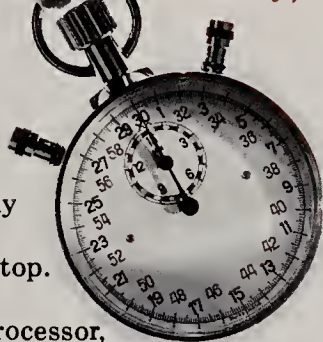
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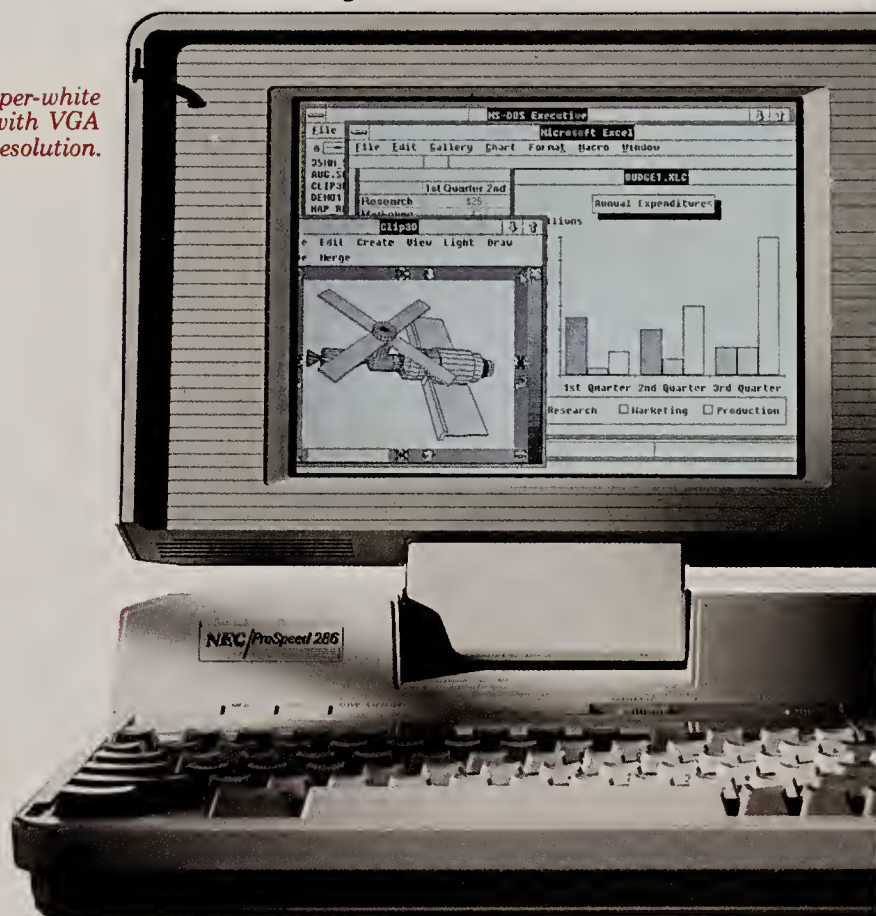
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LINGUISTS

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**Sony
Corp.
of
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Competitive advantage came down to having the tools in hand to make a tight deadline

When Sony Corp. of America was negotiating the acquisition of Columbia Pictures, the company had 24 hours to furnish the federal government with 20 important documents.

Without a fourth-generation language, Sony could have lost the \$3.4 billion opportunity, according to Robert A. Schwartz, vice president of business systems at the firm's Park Ridge, N.J., facility. "We had literally 24 hours to put together various reports and analyses," Schwartz recalled. "We did most of it with FOCUS," a fourth-generation language from Information Builders Inc. in New York.

Surprisingly, Sony management assigned only one person to the task. "But that's where FOCUS is at its best," noted End User Computing Manager Gary Fischer, who wrote the reports. "You don't want to use COBOL for that. You would be crazy to attempt it."

Still, COBOL has its place for report writing. "If you develop a large report that you run every day, it's

worth the time to invest in COBOL," Fischer said. "But if you don't run the report very often, or [if] you change it a lot and it's critical, then we use FOCUS. We can change it very quickly and [we] don't have to worry about CPU time, because it's not processed daily."

Earlier in the acquisition process, Sony had one week in which to file 25 reports with the government. With FOCUS, Fischer was able to complete the job in three days. As a result, Fischer said, "any time there is a critical report, people run to me and say, 'Make a FOCUS report.'"

The firm's IS department supports about 2,000 users on IBM mainframes and PCs. Because many end users can write their own reports in FOCUS, the 100-person IS team can concentrate on more complex systems, Fischer said.

Sony first chose FOCUS almost four years ago to help PC users download information stored on the mainframe, according to Schwartz. "Now we are evolving toward using FOCUS for actual applications in some cases," he added.



ROBERT SCHWARTZ: *A 24-hour 4GL application made a crucial difference in Sony's acquisition of Columbia Pictures.*

One of the applications developed by the End User Computing group helps executives analyze daily orders. Mainframe FOCUS applications automatically extract the previous day's sales figures, update the month-to-date totals compared to budget, and download the information to executives' PCs. PC/FOCUS programs format the data into an executive reporting and inquiry system that is ready for company officials to use first thing in the morning.

Computer-savvy end users developed a customer-support system that funnels reports to PCs in Sony's field-sales-division offices. "End users did most of the development

themselves, but it was augmented with outside contractors—more as an additional set of hands [than as needed expertise]," Schwartz said.

FOCUS is easy for heavy-duty PC users to learn, but Schwartz said it is "not readily adaptable to the person with no experience; we haven't seen any executives picking up FOCUS."

Although FOCUS users are encouraged to write their own reports, Sony IS managers find they must guard mainframe resources carefully. "Because FOCUS is very high-level, a few lines of code generate many instructions," said Schwartz. "And you have no control over how the commands are operating or utilizing

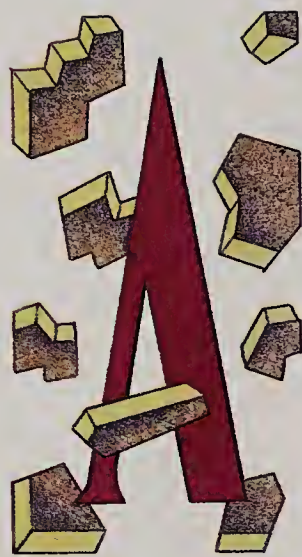
the machine. We've had an end user literally [cause] the mainframe [to] develop serious performance problems that impacted our production system."

While FOCUS speeds the report writing and simplifies the process of making ad hoc queries, Sony is reserving COBOL and CICS (Customer Information Control System, an IBM operating environment) programming for its mission-critical production systems. For high-volume transaction systems, said Schwartz, the company plans to use CASE technology and code generators to automate the application-development process.

PHOTO BY PETER VIDOR

NASA Johnson Space Center

Helping many users of diverse platforms
navigate through vast galaxies of
data required a friendly, flexible interface



At the Johnson Space Center in Houston, most users store different kinds of data in different formats on different machines. "Typically, managers find they don't know where the data is," said Lloyd Erickson, an engineer with the center. "And, if they do know where it is, there's no user-friendly way to get to it," he added.

Thanks to NOMAD, a 4GL from MUST Software International in Norwalk, Conn., accessing data from diverse databases is no longer a problem at Johnson Space Center, an arm of the National Aeronautics and Space Administration (NASA). The NOMAD application runs on a PC and provides users with a transparent window to such dissimilar software environments as ORACLE from Oracle Corp. in Belmont, Calif.; dBASE II from Ashton-Tate Corp. in Torrance, Calif.; ADABAS from Software AG of North America in Reston, Va.; and NOMAD.

"One user was able to access data with no training at all, so we feel there's virtually no training required to get the data," said Erickson. The report writer consists of cascading windows that enable users to backtrack if they get lost or forget what they were doing. "You always see where you've been, at every moment."

If users are not sure what to type, they hit a function key—the same one every time—and a window pops up showing all valid entries. "You never have to remember anything," he said.

If it weren't for NOMAD, Erickson believes, the data-access problem would go unsolved. "NOMAD is probably the most complete 4GL in terms of syntax and capabilities," he said. The language is rich and pro-

vides programmable windows.

With NOMAD, space center IS professionals constructed a main-frame program that takes advantage of IBM's Systems Application Architecture and Common User Access environment, enabling users to work in a consistent interface from one type of machine to another. "Now people can use the program from any location," said Erickson.

NOMAD is such a complete language, according to Erickson, that he dives into third-generation technology only if he requires a scientific function that can be more rapidly evaluated in FORTRAN. "But in terms of database aspects, there's no reason to use FORTRAN or any other language."

Systems analysts can learn to build applications and write reports in NOMAD in just a few days, Erickson said. But the language is not for naive users. "NOMAD is certainly easier to use than a 3GL, but 4GLs are not as user-friendly as people would like you to think they are. A [non-technical] manager is not going to go out and build NOMAD applications."

Still, NOMAD does offer report-writing tools that allow users to search a database without learning its syntax. An accountant or other professional who understands computer programming can learn to write NOMAD reports with either the tools or the language itself, according to Erickson.

For massive production systems that employ large amounts of data, Erickson recommends that organizations hire skilled consultants or programmers to design and implement fourth-generation applications. "The native language for reporting is very straightforward," he said. "But for programming procedures, it becomes more complex because of the power of the language."



LLOYD ERICKSON: access for the untrained

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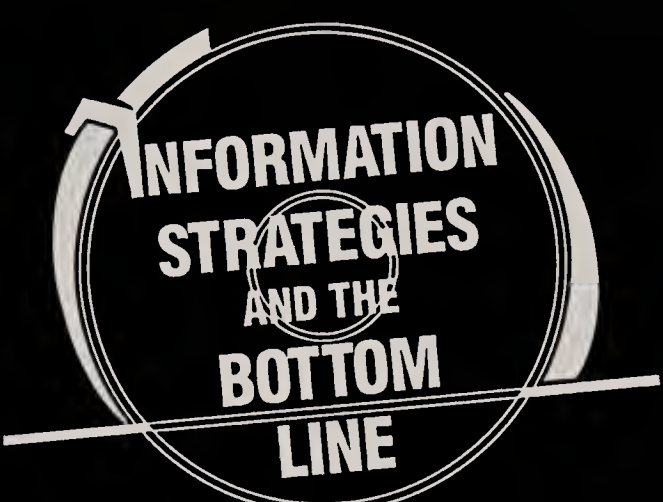
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Turner Broadcasting System Inc.

A 4GL accelerated the task of turning a library card catalog of some 82,000 film titles into an online resource

.....



Line by line, C programmer John Wheeler worked out one small section of a massive library database application for Turner Broadcasting System Inc. (TBS) in Atlanta. In two months, Wheeler presented his handiwork to Barbara Linebarger, the company's library services manager.

When the department decided to switch to Informix-4GL Rapid Development System, a fourth-generation language from Informix Software Inc. of Menlo Park, Calif., Wheeler could turn out the same amount of work in just two weeks, reported Linebarger.

"By using a fourth-generation language, John is able to produce code at a much faster rate," said Linebarger. "The end result is [that] I get the product I want very fast." What's more, she added, "I can personalize

the program to fit my needs. Changes are no big deal."

In all, Turner's Entertainment Division is responsible for 82,000 videotapes and films available for broadcast on the firm's Superstation WTBS and TNT cable channel. The automated system will cross-reference movies, situation comedies, series, cartoons, past sporting events and special programs. "For one film or title, you can have up to 30 different pieces of tape," Linebarger said.

Under the old system, all titles were filed in a traditional card catalog. If programming producers wanted to know how many films TBS owned that starred Lucille Ball, for example, the task would be nearly impossible.

Today, a 386-class IBM-compatible PC running SCO Xenix (a UNIX operating system distributed by Santa Cruz Operation Inc. in Santa Cruz, Calif.) can perform the task within five seconds, said Wheeler, a Turner information systems designer/programmer. With Xenix, Wheeler configured the PC as a multiuser system with several dumb terminals.

The database search system

changed the way Turner employees view the library. "It's a creative resource," said Linebarger. "We can speed a project up by giving them one resource. Instead of people wondering if we own certain titles, they can call in and find out quickly." Eventually, a dial-in capability will enable employees in remote locations to conduct their own searches.

Wheeler, an Emmy-award-winning audio engineer, picked up computer programming on his own. After mastering the C programming language, he attended a local UNIX user group meeting and learned about Informix-4GL. The vendor was offering a special price, so Wheeler encouraged TBS to take advantage of it.

Wheeler's C background helped him master the new language. "Much of Informix is C-like," he observed. "[And] in many cases, Informix is turned into C code. If you know both, you can figure out how it's going to do what it's going to do."

Although Informix runs efficiently in a UNIX environment, Wheeler said the Informix MS-DOS version is unwieldy. "Informix takes advantage of UNIX," he explained. "If one user runs an application in memory for our library database program and another user wants to access the system, it doesn't load another copy; it simply accesses the same copy the first person pulled up."

Wheeler also finds Informix-4GL to be flexible. "The programmer decides what the program does," he said. "It's not the other way around. I want to be able to have that option. The speed of compilation and the speed of development are phenomenal."

The swift development is giving librarian Linebarger a different problem: how to speed the data-entry process. "John can write the program a lot faster than we can get the data entered into the computer," she said.



JOHN WHEELER: The 4GL's "phenomenal" speed gives more flexibility to the programmer.

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Mind Over Mountain

With technology spewing forth an inexhaustible ore of raw information, the hope of refining out useful, actionable 'chunks' rests on new ways of managing data and supporting its consumers

BY JOHN CLIPPINGER

There is an old saying on Wall Street that the bell doesn't ring at the top of the market. In short, major trends don't announce themselves; they just seem to happen. The surface of the water is calm, the air is still, and suddenly the skies erupt.

One consequence of the continuing technological ferment that began in the 1980s is that the volume and velocity of information will increase within organizations. As the costs of producing and distributing information continue their sharp decline, the boon of information technology risks becoming its bane. With the "overproduction" of information has come its devaluation. The results are information overload and gridlock. The scarce resource is not information but mindshare—the user's attention.

The role of information management today differs radically from its pre-electronic predecessor. Information can no longer be regarded as belonging in such rigid contexts as books, reports and other printed materials published at fixed

intervals and with a shelf life measured in

years. Consider instead the metaphor of a refinery, where information is continuously produced from raw materials into a variety of finished goods and where volume, velocity and the value of information to its consumer change constantly. In order to anticipate and effectively cope with these fluctuating conditions, the CIO will

need to think in new ways about how information flows and is used within the organization.

In the 1990s, CIOs will not be able to micromanage the myriad technologies and applications that will abound in organizations. Instead, they will need to think about how technological and business choices can be orchestrated to increase the value of information to the firm. The information infrastructure and policies of the organization will need to be designed so that information is managed to enhance its quality and usefulness. Webster's defines a refinery as a device for "removing impurities from a crude or impure material." An information refinery not only separates out the impurities, but breaks down material into a basic form so that it can be further processed and recombined into new types of end products.

Since new information can be generated by virtually anyone within a distributed organization, and since the internal and external business of the organization will increasingly be transacted digitally, information overload and gridlock will intensify, caused not only by inadequate bandwidth or processing capacity, but by the inability of users to separate the information they need from all the information available. In short, noise could soon replace information.

These trends will force CIOs to rethink the IS function within their organizations. Instead of trying to control what is produced, when and by whom, CIOs will be charged with managing a process wherein the main issues are the integrity and capacity of the network, connectivity, standards, the allocation of "intelligence" in the network, and the pricing of services. The mission of those in



charge of the infrastructure should be to make it as open and as responsive as possible to user needs.

It will also fall to CIOs to safeguard the quality, security, integrity and asset value of the information. Thus they must establish and enforce policies to assure the quality and integrity of the content of what is produced as well as who can produce it, access it, receive it and change it. As demands for information sharing and integration increase, the IS executive will need to translate corporate policies and objectives into data models and information-architecture principles. This will be one of the biggest challenges facing IS executives.

Increasingly, information will not be thought of as an overhead item but valued as a critical input into the work process. Technologies and policies will evolve for processing and managing information in terms of its content value. It will be the responsibility of the IS executive to provide the infrastructure, procedures and tools for the timely distribution and sharing of the right type of information. Success will be judged on quality, not quantity. Smarter management will require thinking about information at a level on which the support of users sharing information in and among workgroups is appropriate to their specific objectives.

The metaphor of the information refinery stresses two points about organizational design: Information is continuous; information is continually being transformed from a raw state to a more finished state. Traditional IS models call for information to be collected and reported upward; the refinery metaphor makes no such presumption about hierarchy. The point of the refinery process is to add value; this can be done by anyone, anywhere in the value chain.

A major prerequisite for information refining is that raw information be digitizable. Inexpensive and effective optical-scanning and character-recognition products make it possible to digitize magazines, faxes, newspapers, memos, product sheets and other materials.

The need to devise effective refinement strategies intensifies with

The information infrastructure and policies of organizations will need to be designed so that information is managed to enhance its quality and usefulness.

the proliferation of such raw data sources as EDI; E-mail, distributed processing and groupware applications; and third-party online information services. In addition, the technologies for transporting and storing vast quantities of digitized information (writeable, erasable optical disks; VSATs; fiber-optic broadband networks) are becoming more sophisticated and less costly.

The imbalances of the forces of information generation can be countered by a class of technologies that sift out the wanted from the unwanted information, and thereby deliver finished value to the end user. The technologies below are important because they make the information more usable:

■ **Format conversion and translation technologies.** The move to document-description standards and the advent of products for translating among different formats, file structures and conventions are vital first steps toward making information more useful. Digital Equipment Corp., Xyvision and others now offer products for sharing files and formats among different vendors and applications.

■ **Filtering, indexing and classification technologies.** Relatively simple off-the-shelf text-filtering products can achieve significant "rough-cut" reductions of unwanted information. More sophisticated technologies, such as those that can recognize equivalent ways of talking about the same thing or resolve word-sense ambiguities, can classify articles and text segments to offer refined, usable information.

■ **Software organization and manipulation technologies.** The most significant development in software technology over the last 20 years may be the development of object-oriented programming—the ability to encapsulate software functions as "pluggable" modules. Object technology provides a powerful means for coping with information overload problems by offering the same techniques used in human thought—"chunking" or the progressive synthesis of information into a hierarchy of object classes. Since object classes often constitute the underlying organization of the content of a text document, they lend themselves to coping with information overload, refining and synthesis.

■ **Hypertext and Hypermedia.** Apple Computer Co., through its Hypercard product, was the first computer vendor to show how new types of non-linear documents and publications integrating graphics, text, video and sound can be created simply. Hypertext products link parts of different documents according to their content. Hypercard has proven to be an effective educational tool and is one of the first text products to exploit the malleability and shareability of electronic text.

■ **Supercomputer performance at PC prices.** One of the grating factors in coping with huge amounts of information was processor speed and capacity. Although software has long been available for the more sophisticated parsing and recognition of text and other forms of semi-structured information, in the past its use has led to commercially impractical performance degradation. Gains in processing capability make this no longer the case, but current commercial products fall dramatically short of exploiting what is technically possible on today's and tomorrow's workstations and servers. Moreover, given the rate at which the processing power of microprocessors is increasing, the PCs of the 1990s will offer many of the processing and storage capabilities of today's supercomputers. Software and information vendors will be able to develop applications that have the system work with rich representations of the information

streams they are processing.

■ **Retail-based channels for system integration.** With the enormous price-performance gains of computing technologies, once-byzantine IS projects may soon be purchased at a fraction of the price through the systems-integration arm of a retail chain. The move is away from "building your own from scratch." IS executives will be able to purchase or assemble off-the-shelf components and applications for many sophisticated information-collection and refinery applications.

In the 1990s, there will be an impetus to develop refinery technology to the point where much of the process of acquiring, organizing and publishing information can be partially or wholly automated. Initial efforts will be ad hoc and reactive, but as the technologies and the organizational issues are sorted out, deliberate designs for refineries will emerge that drive new products and applications categories:

Level 1: Literal Term Refineries—

We are beginning to see the first generation of information refineries, primitive, early examples of the refinery function. Typically, they represent an ad hoc solution to a pressing information-overload problem and are limited to working with literal terms, keywords and synonym lists. For digital text feeds or E-mail applications, such refineries filter out many unwanted documents. Thesauruses, assorted literal terms and string-matching techniques facilitate and improve text retrieval applications. However, filters built with lists of literal terms are still quite coarse, and consequently do not filter out many terms and "impurities." They suffer from poor recall performance (retrieving all the documents relevant to the query) as well as poor precision performance (retrieving only the documents relevant to the query). One of the problems with literal-term refineries is that the uninitiated credit them with more power than they possess; and when they fail to meet expectations, there is often an overreaction of excessive pessimism and skepticism.

Level 2: Hybrid Refineries—As the weaknesses and deficiencies of

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string-matching techniques become apparent, there will be a move in the commercial software marketplace to offer incremental improvements. This second level will attempt to take more advantage of the available processing power and perform some elementary language processing in conjunction with string matching and assorted statistical techniques. Hybrid solutions can prove to be highly effective for well-defined applications.

Level 3: Object Processors—Full-scale, high-performance Level 3 refineries will come into their own as object technology achieves commercial acceptance and is integrated in the applications and systems environments of firms. The full potential of an information refinery requires not only the elimination of impurities from the raw or crude information, but the breaking down of the crude information into a form where it can be further refined in successive processes. A complete refinery should be able to take information from diverse sources—in diverse formats and covering diverse topics—strip out all its impurities and transform it into a basic form that can then be reprocessed, refined and rendered into a variety of specialty products and services. Object technology provides the ideal medium for building refineries because the role of the refinery will be to recognize objects in text and facilitate their sharing and recombination with other applications. In the object environment, the focal point of publishing won't be the page or the document, but the object. Other applications include the population of databases from free text

sources, the generation of composite publications and a variety of alerting and agent-based applications.

There comes a time when a change in degree initiates a change in kind. The 1990s will be such a time. As organizations make the change from time- and place-bound enterprises to fluid electronic networks, the corporate functions, missions and policies will dramatically change. The information-technology function will become more visible, and at the same time more threatened, as its role continues to be debated and redefined. The new organizational importance of IT will be more widely acknowledged, which will subject the IS function to higher expectations. Three attitude adjustments will prepare CIOs to survive change:

■ **Don't be a King Canute:** You can't command the tide to turn. We are in for a big change. Rather than resist it, harness it; recognize where it is going and what its near-term and long-term implications are for your organization. You will probably have to change your terms of reference. The information-refinery metaphor may be a useful way of thinking about both your organization and your function.

■ **Don't be blind-sided:** Technologies that seemed stalled and moribund just a couple of years ago may soon be charging ahead at full tilt. Different technologies have an odd way of interacting with one another to completely alter the playing field and to throw off the most considered technology forecasts.

■ **Anticipate and educate:** In the case of major technological changes, anticipation is key; either you ride the wave, or the wave rides you. Understanding the forces shaping your environment is essential. Technology can be complex and changing, but you have to understand it sufficiently to see its implications for your mission and your organization. You will need to educate others in the IS function and users, decision makers and the architects of corporate strategy and policy. ☐☐

John Clippinger is a Cambridge, Mass.-based consultant in applying text-processing and decision-support technologies in organizations.

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Master Planning

The purpose of an IS steering committee is to plot long-range issues on a grand scale, not to pilot day-to-day operations

BY LINDA H. FLEIT

In theory at least, an information technology policy or steering committee can be a big help to the information systems department in several ways. It can be instrumental in setting forth the organizational goals that need to be met by technology. A policy committee can also provide a unifying direction and can set up the criteria and a framework against which technological progress can be measured. If nothing else, simply having a forum in which technology issues can be discussed at a high level is a worthwhile reason to have a policy committee.

But that's just the theory. In practice, it doesn't seem to quite work out that way. Many organizations have a policy committee in name only: It exists on paper, but it never meets. Even if it does meet, rather than being an aid to the organization, it simply wastes the time of everyone involved. Other organizations resist the whole idea of creating a policy committee, or have tried it and then disbanded it in frustration. Some CIOs even view policy committees as threats to their decision-making prerogatives rather than sources of improved communication with the organization's other executives. Worst of all, many committees simply degenerate into user complaint sessions attended only by proxies for the committee's actual

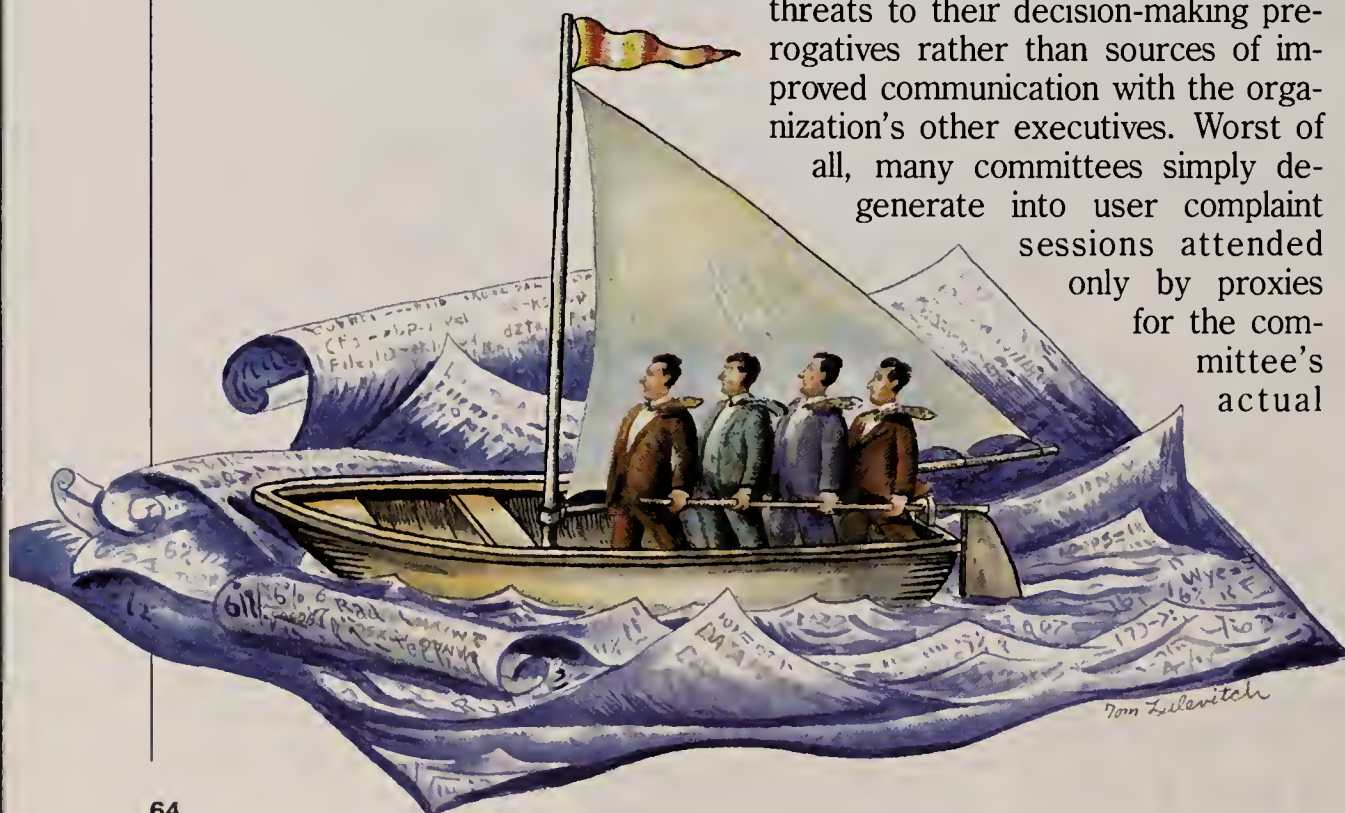
members.

So in spite of its potential benefits, the policy committee is either nonexistent or not functioning properly in a great many organizations. Misunderstandings about the committee's role, function and makeup abound.

The purpose of the committee is to ensure that the organization is getting the maximum benefit for its technology dollar. A CIO can't do this alone, nor can the IS department working in isolation. A policy committee is a complementary mechanism designed to articulate the organization's mission, foster communications, and make sure that the company's executives are both contributing their input as business people into the technology area (something that is desperately needed) and receiving the technology assistance and education they require.

The single most important attribute of a policy committee (and one that is too often ignored) is that it be very high-level in both its membership and its agenda. In addition, the purpose and stature of the committee—as well as its focus and attention—should be clear to the original organizers, the committee members and the IS department alike.

As an example, let's look at the matter of establishing priorities for IS. The committee should not be involved in actually setting the priorities; this should be left to an operational-level committee (whose overall charter has been mandated by the policy committee); rather, the appropriate subject for the committee to discuss is the priority-setting process, since this is an upper-level concern that needs to be resolved from the top down. Establishing guidelines and criteria against which specific requests can be measured is the proper task for the committee. Deciding on individual requests for



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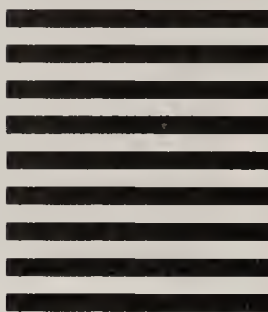
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services or making determinations about user precedence are better left to the operations committee.

In financial matters, the committee should concern itself with long-range issues such as funding patterns and sources rather than with more immediate considerations such as monitoring the annual IS budget. The latter is inappropriate not only because the IS budget is usually only a fraction of total organizational expenditures for computing, but because the longer-range issue of patterns and sources is much more far-reaching and strategic in its consequences.

The purpose of the committee is not to manage IS, either directly or indirectly, or to usurp any of the decision-making authority of the CIO. While maintaining a strategic focus, the committee's most important function is to ensure that long-range organizational needs and goals are being well-communicated and met. Significant technology issues should be brought to the attention of the highest level of the organization, and the policy committee is the right forum in which to do so.

Another important attribute of the committee (and another reason for it to be positioned at a high level) is that it should be a unifying group with an organizationwide focus. It should report directly to the president or to the top executive level of the organization. Its membership should consist of people who can not only represent their own areas of responsibility but take a broader focus as well. It need not necessarily include users—since day-to-day computer usage issues will almost never be discussed—and should exclude people whose organizational perspectives are limited to their own departments or divisions.

Technology should be an integrating mechanism for the organization, and the makeup of the policy committee needs to reflect that. Clearly, committee members should also have an appreciation for technology. Not that they need to be experts, but they should at least be thoroughly familiar with the concepts. Understanding the ways in which computing can contribute to the success of the organization is a committee mem-

The vision that must be articulated is how technology can fulfill its potential in a timely and cost-effective way.

ber's most valuable asset. That understanding comes from familiarity and appreciation.

The committee should also serve as both the instigator and the enabler of long-range planning efforts. It should provide a vision for organizational technology initiatives and a direction toward which all efforts should be focused. The central issue for the committee, and the vision that must be articulated, is how technology can fulfill its potential in a timely and cost-effective way. Without this vision, planning is virtually useless; without planning, the organization has no way of assuring that technology dollars are being well spent.

The meetings themselves should be conducive to high-level participation, and they should be held only as often as necessary. Overly frequent, regularly scheduled meetings tend to offer little to warrant the participation of busy executives; really stimulating and important topics rarely present themselves at such convenient intervals. Executives who feel they are wasting their time will send proxies, defeating the whole purpose of an upper-level steering committee. However, if the committee only meets when there is something genuinely worthy of its attention, members will attend themselves and will come to rely on this forum as an efficient way to get their own problems solved.

Similarly, the meetings should follow a pre-publicized agenda and make good use of the attendees' time. The chair of the committee should be someone with an organizationwide perspective and stature—someone who can truly help integrate the use of technology into the organization as a whole. (Unfortunately, in all but the most progressive organizations, this is unlikely to be the CIO, who is of-

ten still regarded as "the computer person.") The chair should see to it that technical jargon is kept to a minimum and that the meeting atmosphere encourages pertinent discussion. The chair also needs to keep the meeting from degenerating into day-to-day concerns.

Finally, the committee should be well-established in the organization so that it is not simply a group formed to react to a crisis. A high-level body of this nature, created in response to a problem (however major), is inevitably going to focus on that problem rather than on the underlying causes and contributing factors. It may very well dispose of the immediate crisis, but it is then likely to disband, assuming that its work is done.

There will not always be a need for policy committees. As technology becomes integrated into the organizational mainstream, as the organization's executives gain a better appreciation for technology's costs, benefits, and risks, and as the CIO becomes a full-fledged member of the management team, the need for a policy committee will gradually disappear.

For the time being, however, an upper-level body designed to advise the organization's top executives on the most effective ways to exploit technology, to advise IS on organizational goals and priorities, and to provide a forum in which executives can become knowledgeable and sophisticated about technology issues is not only necessary, it is vital for genuine progress. Working in partnership with the CIO, the committee can be one of the vehicles through which technology contributes to the organization's success.

If the committee's focus is kept on long-range rather than day-to-day issues; if the meetings are held only when necessary rather than on a pre-arranged schedule; and if the committee is made up of the right people and they are given the right charter, then there is a significant opportunity for the policy committee to provide direction, insight and vision to the organization's computing effort. ☐

Linda H. Fleit is president of Edutech International, a management and technical consulting firm based in Bloomfield, Conn.



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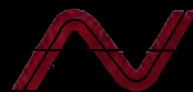
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Association for Systems Management
216 243-6900

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Computer-Aided Software Engineering

Radisson Plaza, Orlando, Fla.
February 1 & 2
Association for Systems Management
216 243-6900

CASE concepts and current availability of technology are examined in this seminar. CASE product developments, directions and implications are discussed as well as techniques for evaluating CASE. Several demonstrations illustrating CASE tools are featured. Registration fees: \$595 for members; \$670 for non-members.

Information Strategies and the Bottom Line

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February 4-6
CIO Magazine and AMR International
508 872-8200

Objectives of this conference include underscoring the expanding role and influence of

CIOs; identifying the top business priorities of CIOs; improving CIOs' communications with top management; and focusing on the CIOs' managerial concerns vs. technological issues. Registration fees: \$995; \$1395 for government/military (includes hotel).

Developing and Using the Information Systems Architecture

Westcourt in the Buttes, Tempe, Ariz.
February 5 & 6
The Dooley Group
612 935-8022

A seminar on shaping technology strategy to fit business strategy through the development and use of information systems architecture. Specific technologies to be discussed are CASE, telecommunications, EDI, document processing, end-user computing and data management. Registration fee: \$950.

NetWorld 90 Boston

Hynes Convention Center, Boston
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CONFERENCE CALL

QUESTION: *Is application development at the business unit level all it's cracked up to be?*

The promise of more efficient, cost-effective systems has won many converts to decentralized application development, but CIOs agree that the systems development structure must reflect the structure of the organization.

Thomas English

Vice President of Information Services for Federal-Mogul Corp., Southfield, Mich., a centralized manufacturer of parts for the automotive industry.

“It's the right direction. We've had mixed success with it. Users are taking more responsibility for report generation and that kind of task, but MIS still takes on the bigger things. The user community isn't up to the skill level that they'll need [to develop more complex applications].

“Users need to be much more involved in the design phases, and to pick up more responsibility for report generation by using 4GLs. [User involvement] is not an issue of saving money. It's more an issue of being more responsible, because we have limited IS resources and, obviously, if we can include [users] in our resource pool, we can be more responsive [to their needs]. Their input makes for a [better designed] product.”

Donald R. Lasher

President/Information Services Division, United Services Automobile Association, San Antonio, Texas, a centralized insurance and financial-services provider.

“If you don't need to integrate the various systems to share data, to pass data back

and forth, in an attempt to get synergistic effects between business units, then application development at the business-unit level may very well make sense. This is not the case with USAA because we want to put forth a single image to our customers. We have to at least fully interface all of our systems, if not fully integrate them.

“Most important, we want to have a common view of our customer. All of our stuff is online. We want to be able to call up a screen [when a customer calls] that tells us what lines of business this person does with USAA. We want to be proactive in [selling products].

“With [decentralized application development], the seamlessness [owing to the uniformity of data and applications] is gone. Now, does it have to be gone? No. But my experience tells me that [this seamlessness] will eventually erode because [the business units] have to do what's cost effective . . . and we may not be able to control it.

“If you happen to be a conglomerate like ITT, [decentralized

application development might work.] When I worked for ITT, they did Wonder Bread and Twinkies, were a major telecommunications company, and owned one of the largest lumber and cellulose producing companies, and one of the largest valve producing companies. Well, there's damn little synergy between those kinds of business.”

John D. Loewenberg

Senior Vice President of Corporate Information Technology Services for decentralized Aetna Life & Casualty, Inc., Hartford, Conn.

“My basic opinion is [that decentralizing is] the only way to do business. As we continue to evolve and we really get the technology to be an integral [part of] the business, the business strategy and business plans have to drive . . . the technology. The only way to achieve that is for the current separation between so-called business people and systems people to disappear. The business information system represents how the business is going to work. Anytime you

give someone an application to develop, you assume that the business is going to stay the same. In our business that isn't true. I've [managed centralized IS groups] and I've pushed them out because of the communications gap that existed between the systems people and the business people.

“Emerging development methodologies point [toward decentralization]. You've got to be side-by-side with the guy who wants and uses [the application]. The more the systems person understands that side-by-side [cooperation], the better [the application will be.] We're trying to get the business-unit managers to feel that they can manage the technology resource as well as they can manage the human resource and the business resource.

“Some of the traditional methodologies will disappear. Hopefully, developers won't have to do data retrieval. [Report writing] will become a lost art from the systems standpoint. That's where one of the real big productivity breakthroughs of the future will be.”

Readers are invited to suggest Conference Call questions. Contact Staff Writer Meghan O'Leary at 508 935-4733, or by fax at 508 872-0618.





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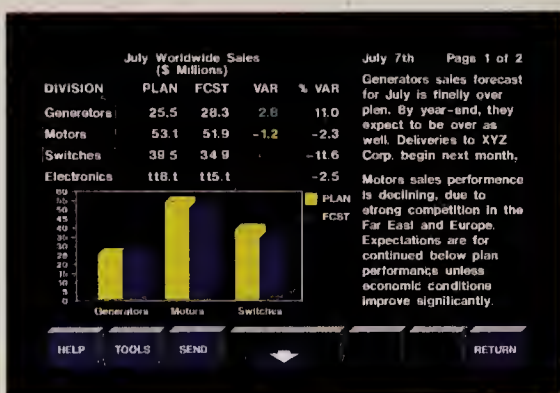


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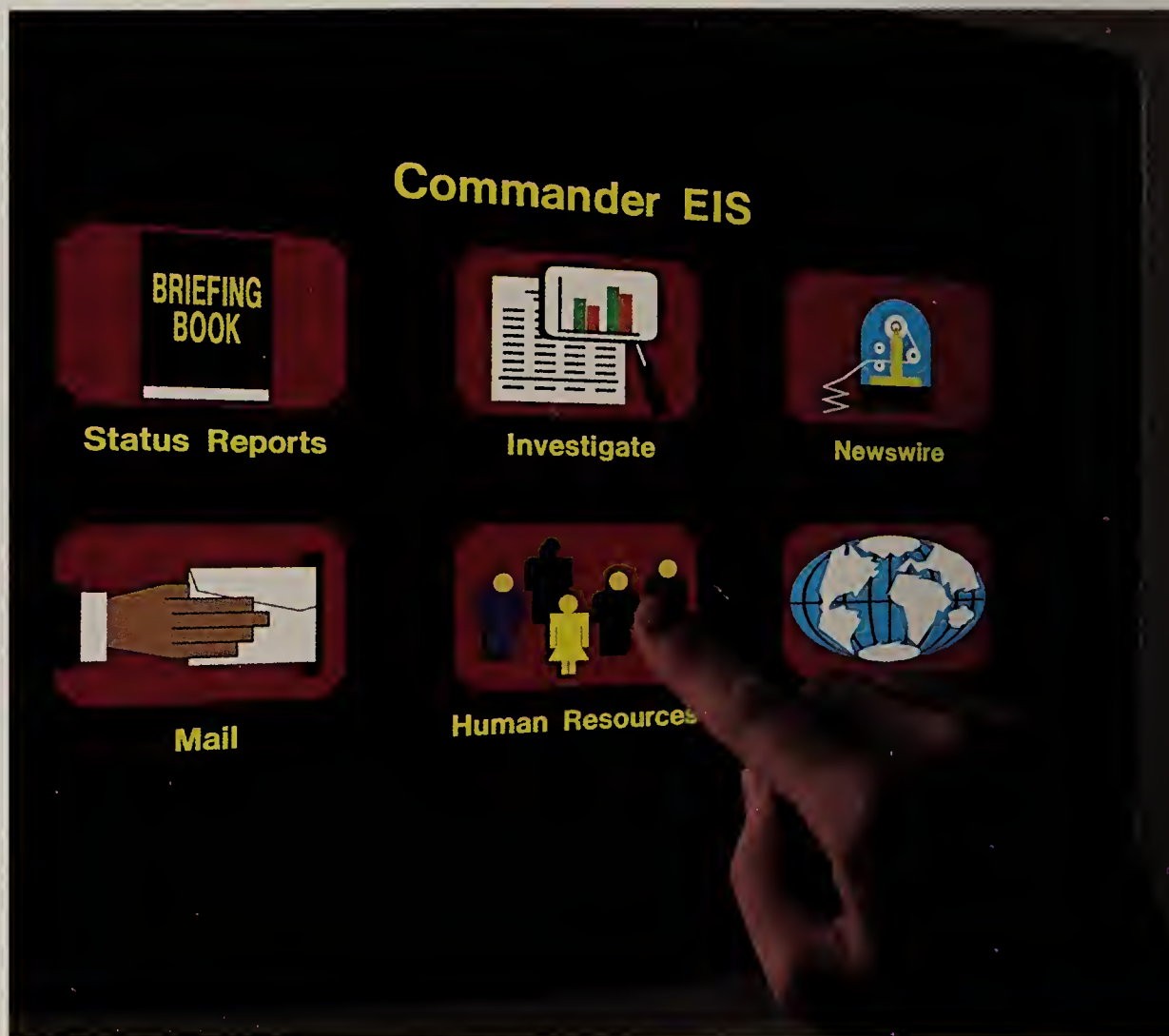


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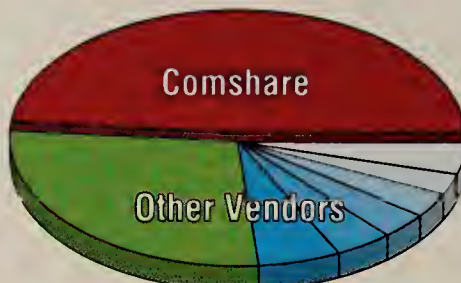
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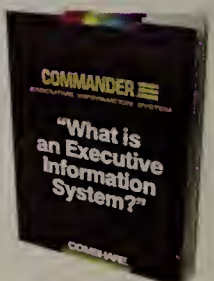
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